Videocard Shocker

EVGA's GeForce GTX 580 smashes our Lab records! p. 76

History's Best Handhelds

From the abacus to the iPhone, we reveal the 10 most influential mobile devices p. 14

SILENCE YOUR PC!

We explain what parts to buy and how to put it all together! p. 64

MAXIMUM PC

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101 Killer Websites

You must see today

Amazing. Bizarre. Stunning. We name the Internet's most awesome destinations! p. 24

Tablet Shootout!

Two new Android tablets: Can either compete with the iPad? p. 78

Intel's Sandy Bridge

Chipzilla's stellar new $300 CPU outperforms its $1,000 processor! p. 38

$8.99US
02
Future MEDIA WITH PASSION
0 70989 38753 9

DEATHMATCH: BOXEE VS. GOOGLE TV p. 16

FEBRUARY

FEATURES

24 101 Destinations
Sit back and point your browser to these must-see websites.

38 Intel's Next Leap
We test the new, high-performance Sandy Bridge CPU.

46 MakerBot
Imagine printing any object you desire.

DEPARTMENTS

Quickstart

08 NEWS Comcast vs. Level 3; new chips and lower prices from AMD.

14 THE LIST The 10 most important handheld devices of all time.

16 DEATHMATCH Boxee Box vs. Logitech Revue.

R & D

54 WHITE PAPER Graphene: The material that will likely change our world.

55 AUTOPSY Inside the OnLive microconsole.

57 HOW TO Clear up drive space without deleting games or media; take control of the Windows context menu.

64 BUILD IT A quiet gaming PC.

In the Lab

73 REVIEWS

92 LAB NOTES

96 BEST OF THE BEST

LETTERS

20 DOCTOR

94 COMMENTS

38

MAXIMUM PC

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Fresh Start for a New Decade

I'm old-fashioned in that I spend a little time during the holidays making a list of resolutions and goals for the New Year. I try not to, um, over promise, but I also try to be more ambitious than saying I want to eat better, drink less, blah blah blah. (By the way: I blame the Internet and print deadlines for all sins.)

I'm not going to get into all of my personal goals, but I will publicly commit to the following technological resolutions for 2011:

BUILD A SANDY BRIDGE GAMING PC I'm embarrassed to admit that I'm running a fairly old gaming rig at home—an overclocked Core 2 E6850 CPU paired with a GeForce 460 card and a 128GB solid state drive. Hey, it works great for gaming. Thankfully and conveniently, my shame is tempered by the fact that, based on our initial Lab tests, Intel's new Sandy Bridge architecture looks very promising. I'm shooting for February or March for this resolution.

BUILD A MODERN HOME SERVER Until now, I've been relying on a blend of Internet services (Carbonite, if you're curious) and an external drive to back up the four computers on my home network. That's going to change this spring when I finally build out a Windows Home Server based on Microsoft's new Vail release candidate. Automated backup and media streaming will just be the tip of the iceberg here. Hopefully.

CUT THE CABLE 2011 is going to be the tipping point for IP-based TV and movies. Between Netflix, the pro sports packages that are popping up, and services like Hulu, I think we're finally going to have access to almost everything we want to watch via the Internet. I'm looking forward to lopping $100 off my monthly bills, that's for sure. I'm penciling in this project—and a related cover story—for the summer.

A KITCHEN PC Thus far, I'm less than thrilled with my kitchen computing options. I've tried the all-in-one route, but it felt too big. I've tried a tablet, but it was too mobile. Touch-screen is the way to go, for sure. The answer may be as simple as mounting a smaller all-in-one on a swing arm or suspending it from the ceiling. It might also boil down to a more stable eye-level mount for a tablet. And don't forget about music. I think I'll wait for the tablet market to boil down in the summer before tackling this one.

How about you? What are your tech resolutions for the coming year? Let me know at george@maximumpc.com and I'll publish some of your emails next month (or the month after).

THIS MONTH'S AWESOME

Intel's Sandy Bridge
PAGE 38

101 Amazing Websites
PAGE 24

EVGA GeForce GTX 580 SC
PAGE 76

LETTERS POLICY Please send comments and questions to george@maximumpc.com. Include your full name, city of residence, and phone number with your correspondence. Unfortunately, George is unable to respond personally to all queries.

THE NEWS

Level 3, Comcast Debate Boils Over

Netflix-partner Level 3 accuses Comcast of setting up an Internet 'toll booth' to stream Netflix traffic —PAUL LILLY

We hate to break it to Blockbuster and your local mom-and-pop video rental store, but the future of content consumption lies in streaming media, not physical discs, and Netflix is at the forefront of this new frontier. While announcing quarterly financial results, Netflix cofounder and CEO Reed Hastings told investors, "In fact, by every measure, we are now primarily a streaming company that also offers DVD-by-mail."

With around 17 million subscribers to serve, many of whom are tapping into Netflix via game consoles, set-top boxes, and even mobile devices, it takes a cooperative effort to shuttle all those bits of code from point A to point B. Level 3 Communications, which operates one of the world's largest communications and Internet backbones—also known as a Tier 1 provider—recently inked a multi-year deal to serve as the primary content delivery network (CDN) for Netflix and is responsible for most of the traffic originating from Netflix that ends up in your home after passing through your ISP. One of those ISPs, Comcast, now wants to charge Level 3 to deliver that content to its customers, and Level 3 is pissed.

According to Level 3, the real reason Comcast set up a so-called Internet 'toll booth' is because the cable provider feels threatened by the online distribution of movies and TV shows. This might be especially true following Netflix's recent debut of a $7.99/month streaming-only plan in the United States.

PEERING, LEVEL 3, AND COMCAST

To better understand the dispute between Level 3 and Comcast, we first need to make sense of how the flow of Internet traffic works. Level 3 and Comcast are Internet backbone providers, and both inevitably end up flinging traffic through each other's network. This is known as peering, and typically companies don't charge each other for this mutually beneficial exchange of information.

Level 3 is accusing Comcast of "putting up a toll booth" on the Internet in the form of a recurring fee to transmit streaming media to Comcast's customers. In an open statement, Level 3 warned that "this action by Comcast threatens the open Internet and is a clear abuse of the dominant control that Comcast exerts in broadband access markets as the nation's largest cable provider." Level 3 also contends that Comcast's so-called toll booth runs contrary to the FCC's proposed Internet Policy principles, "as well as Comcast's previous statements" on the whole net neutrality debate. Not wanting to disrupt the flow of Netflix traffic, Level 3 said it had no choice but to accept Comcast's fees, albeit under protest, until the FCC rules on the matter.

COMCAST RESPONDS

Now that Level 3 has brought the whole matter public, Comcast is going to great efforts to convince anyone who will listen, particularly the FCC, that this dispute has nothing to do with an open Internet, online video, or alleged toll booths. It isn't even about net neutrality, Comcast says.

"Indeed, if anything, it is Level 3 that is seeking 'non-neutral' treatment that would favor its traffic over those of all its competitors," Comcast Chief Sharon Gillett wrote in a letter to the FCC.

Comcast complains that the sudden increase in traffic Level 3 wants to ferry through Comcast on a peering basis will throw things grossly out of balance. What's more, Comcast says, "Level 3 is trying to game the process of peering—one that worked well and consensually, without government interference, for over a decade—in order to gain a unique and unfair advantage for its own expanding CDN service."

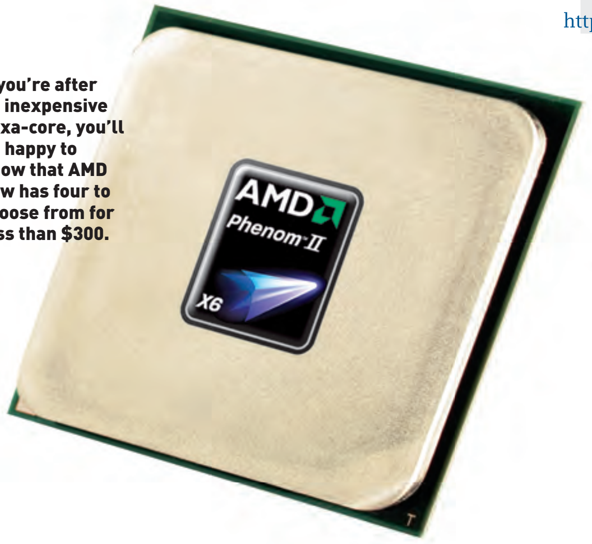
So where does the FCC stand on all of this? At the time of this writing, the FCC was still reviewing arguments from both sides and has yet to comment, but you can bet that when it does, everyone will be listening.

AMD Intros New Chips, Cuts Prices

Anticipating the launch of Intel's Sandy Bridge chips, AMD has introduced three new chip offerings ranging from two to six cores.

AMD has introduced a new dual-core 3.2GHz Phenom II X2 565 chip for $112, a new triple-core 3.3GHz Athlon II X3 455 for $87, and a new hexa-core 3.3GHz Phenom II X6 1100T for $265. The price of the previous top-end 3.2GHz 1090T Phenom II X6 has dropped from $295 to $235.

AMD's desktop lineup is priced well but the chips' prices are fairly compressed. The company has no less than 12 Phenom II CPUs spread between $90 and $265. In the Athlon II lineup, there are 17 CPUs between $66 and $143. **—GU**



If you're after an inexpensive hexa-core, you'll be happy to know that AMD now has four to choose from for less than $300.

FTC Talks Do-Not Track

The Federal Trade Commission is endorsing a proposal giving consumers the right to opt out of website tracking. Just as the popular do-not-call registry protects us from bothersome phone calls by telemarketers, a do-not-track mechanism would protect our online activities from the prying eyes of third parties.

A lack of transparency about what kind of online data is collected, how long it's kept, and how it is used is behind the proposal. As described by the FTC in its testimony to Congress, a browser setting would let consumers opt out of having their data tracked or receiving targeted advertising; once activated, that preference would be signaled to any websites they visit.

Lawmakers and business owners that oppose the proposal say the mechanism could hurt the Internet economy. **—KS**

Twitter Use Dissected

For the first time ever, the Pew Research Center's Internet & American Life Project conducted a study that exclusively examines Twitter users, and this is some of what they found:

▶ Out of all Internet users, 8 percent use Twitter.

▶ The most active demographic belongs to 18- to 29-year-olds, of which 14 percent use Twitter.

▶ Minority Internet users (African-Americans and Latinos) are more than twice as likely to use Twitter as are white Internet users.

▶ Urban residents are roughly twice as likely to use Twitter as rural dwellers.

So, what does it all mean? Perhaps nothing to the average user, but for companies and marketing heads, the survey results, surprising as some of them are, could come in handy. Full results are at http://bit.ly/gZc1Mj. **—PL**

FAST FORWARD

AMD Trades Power for Punchy Graphics

There's no such thing as a free lunch, especially in engineering. Usually, the biggest engineering problem is trading off one aspect of performance for another.

In microprocessors, those aspects are speed, cost, and power consumption. AMD's first Fusion processors are a prime example. They're deservedly winning great reviews for their graphics performance, making the integrated graphics of Intel's Atom processors look like slo-mo instant replay. However, AMD is paying a price in power consumption.

True, AMD did a good job of reducing power to levels appropriate for netbooks and subnotebooks: 9W or less for C-series Ontario chips, and 18W or less for E-series Zacate chips. But when combined with AMD's Hudson south-bridge chip, Ontario burns more power than Intel's Atom N550 Pine Trail-M chipset, and Zacate burns more power than the Atom D525 Pine Trail-D chipset.

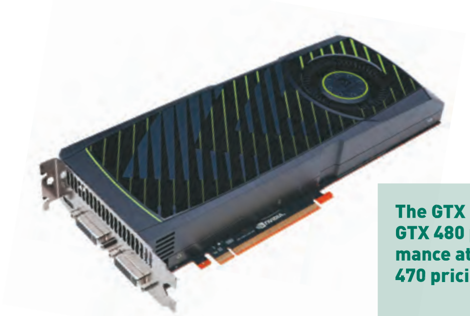
Even a single-core 1.5GHz Zacate uses 5W more power than a dual-core 1.8GHz Atom D525. Although AMD's new Bobcat processor core has some advantages over Atom, those features aren't enough to offset twice as many Atom cores running 20 percent faster.

Graphics performance is a different story. AMD derived the integrated graphics in these first Fusion chips from the Radeon HD 5430 discrete GPU. Some benchmarks suggest that these Fusion GPUs are 30 times faster than Atom's integrated graphics.

Fusion processors are smaller than similarly integrated Atom Pineview processors (75mm² versus 87mm²), but they pack twice as many transistors and are heavily weighted toward graphics. Die photos reveal that the Fusion GPU occupies 34 percent of the chip, whereas each Bobcat core occupies only about 6 percent. In a sense, these aren't x86 processors with integrated graphics; they are graphics processors with integrated x86 processors.

Clearly, AMD is trading power for superior graphics. In the sub-$500 notebook market, AMD is gambling that most users will value graphics over battery life. And if AMD's chip-level power management is effective, users may not even sacrifice much battery life when running software that doesn't strenuously exercise the graphics.

Tom Halfhill was formerly a senior editor for *Byte* magazine and is now an analyst for *Microprocessor Report*.



The GTX 570 offers GTX 480 performance at GTX 470 pricing.

Nvidia on a Roll with GeForce GTX 570

After finally dethroning AMD's Radeon HD 5970, Nvidia looks like it's on a roll. Hot on the heels of the company's kick-ass GeForce GTX 580 card, now comes the GeForce GTX 570.

For the most part, the GeForce GTX 570 is cheaper, slightly cooler, and as fast as the company's GeForce GTX 480 card. The new card features 480 compute cores, 60 texture units, and 40 ROPs, compared to the GeForce GTX 480's 480 compute cores, 56 texture units, and 48 ROPs. The best part of the GeForce GTX 570 may be its price: $350. –GU

Microsoft Targets TV

Sources reveal company's plans for streaming service

It looks like Microsoft's deal with ESPN, which brings the sports channel's content to Xbox Live, could be just the first step in a Microsoft-branded TV service. Reuters is reporting that the software giant is in talks with media companies to license an array of TV programming in the interest of offering subscription-based video streaming to the Xbox 360 and Windows PCs, according to "people familiar with [Microsoft's] plans." Presently, Xbox and Windows users have access to the Netflix streaming service, but it seems like Microsoft might want to cut out the middle man. The sources say the service will probably not materialize for another 12 months. **–KS**

Xbox Live's ESPN with enhanced interactivity could be just the beginning....

Facebook Foe Goes Alpha

We first reported on Diaspora in our August 2010 issue, when the open-source social network site was still just a glimmer in the eyes of four New York University programming students. But having raised well beyond the $10,000 in donations they needed to get their anti-Facebook off the ground, the project developers have now opened Diaspora for business. Invites to the alpha site will be issued incrementally as the developers continue their fine-tuning. As stated in the Diaspora blog, "By taking these baby steps, we'll be able to quickly identify performance problems and iterate on features as quickly as possible."

Boasting the tagline: "Share what you want, with whom you want," Diaspora promises to be the antidote to Facebook's complete ownership and notorious abuse of its users' content and personal info. With Diaspora, you own everything you share on the site, and you control how and to whom it's distributed. The open-source code is freely available to anyone who wants to host a Diaspora server and developers are encouraged to build onto it. To sign up for an invite, go to https://joindiaspora.com. **–KS**

GAME THEORY

The Year That Was

The year has wound to a close as I write this, so it's time for me to sit back, survey the PC gaming field, stroke my chin whiskers, and Think Deep Thoughts.

To hell with that. I feel more like rubbing my hands together, chortling evilly (or is it evilly chortling?), and saying, "At last! I have you where I want you, PC gaming!"

This is the point in a year-end retrospective in which the writer usually injects some boilerplate "death of PC gaming" or "PC gaming is not dead" commentary. Both camps are wrong, because something very large in PC gaming is dead, but something small and precious is springing forth from its bloated, over-budgeted, derivative corpse.

That dead thing is the big-budget marquee PC title. StarCraft II, WoW Cataclysm, and Civilization V are all fine examples of PC gaming, but big, costly sequels are the death of true creativity. Go take a gander at the high-profile titles in any given year and see how many are sequels. The game industry has really taken this whole "go green" concept to heart, because they're recycling every idea they have.

Like Moonbase Alpha in *Space 1999*, PC gaming has broken free from a large planetary body to embark on wondrous and terrifying new adventures. That planetary body was not Earth, but EA, Activision, and Ubisoft.

We've been waiting for The Little Indie That Could to toddle along and prove that PC gaming can thrive free of retail boxes and big budgets. And then along comes Markus "Notch" Persson, logging more than 2,000,000 registered users and selling more than 700,000 registrations for Minecraft, a sandbox game that reviewers 10 years ago would have criticized for its "dated" graphics.

The best game of 2010 wasn't StarCraft II, or Black Ops, or Civ 5. The best game of the year was Minecraft, and it's *not even finished yet*. It proves that the indie model of small teams, low budgets, cheap prices, word-of-mouth, and startling creativity is once again the true center of PC gaming.

Thomas L. McDonald blogs at www.stateofplayblog.com.

Technocel Battery Boost

Our requirements for an emergency battery charger are simple. We want it to be small, lightweight, and capable of quickly restoring life to our smartphone. Technocel's pocket-size Battery Boost ($30, www.technocel.com) does all three, and doubles as a Micro SD card reader to boot, which makes it perfect for our commuter bag. We charged up the lithium-polymer battery by plugging the retractable USB connector into our PC, and then were able to plug it into our dead Sprint Epic 4G's micro USB port to deliver 20 percent power in about 40 minutes. At 3.1x1.25x.75 inches thick, you could even use the carabineer clip to make it a keychain. –GJ

Apple to Make the Switch

Nvidia may find itself in the cold when Apple refreshes its low-end notebooks. The rumors, first reported by News.com, say Apple will ditch Nvidia graphics with the move to Sandy Bridge this year. The decision, if true, is no surprise. Apple's MacBooks continue to use Nvidia's integrated chipset as well as the obsolete Core 2 processors. With Nvidia long locked out of making chipsets for Intel's newer CPUs, any adoption of a new Intel CPU simply could not include an Nvidia integrated graphics component. –GU

CLOUD COMPUTING

Chrome OS Arrives, for Some

Google has distributed its Cr-48 netbook to select system reviewers and industry partners as part of the Chrome OS pilot program. The move brings consumers one step closer to a completely browser-based computing experience. For our hands-on impressions, go to http://bit.ly/hOSVkb. –KS

BYTE RIGHTS

How Not to Save the News

In a well thought-out plan to get rid of their remaining readers, newspapers are turning to suing websites that reproduce their content, regardless of attribution.

In March 2010, Nevada lawyer Steven Gibson decided that the medicine the sickly news business really needed was a good dose of lawsuits. Gibson started Righthaven. It's not a traditional company, it has no product or service. All Righthaven does is look for reasons to sue bloggers, then sues them. Righthaven scours the Internet, and when it finds an article of one of its client papers reproduced online, Righthaven acquires the copyright of the article and slaps the website with a demand for $75,000 and its domain name. Righthaven will, of course, settle for less, around $5,000, so very few of its cases will see a courtroom.

It's clear Righthaven would like to make a lot of money doing this. Less clear is why newspapers, which once understood their noble profession to be tomorrow's bird cage liner, would go in for it. Suing people who link to and talk about your work is as close as the net gets to beating people up because they looked at you funny.

But it gets sketchier. The suits may be totally frivolous. Many of the posts are likely fair use—commentary, reference, etc. Many newspapers provide a sharing or linking function on their website, which is an implied license for doing the thing they just encouraged you to do with those functions.

It's not even clear that some of the cases would rise above what lawyers call *de minimis non curat lex*, a Latin phrase that roughly means a case too pissant to bother involving the courts. It seems doubtful that Righthaven has told its clients how thin these cases really are. Clearly, the lesson from the RIAA was that the industry group simply didn't go far enough on thin enough evidence.

More than anything, Righthaven looks cynical and parasitic. It's looking to make a quick buck from a confused and panicked industry by abusing laws disconnected from the technology they govern.

Quinn Norton writes about copyright for Wired News and other publications. Her work has ranged from legal journalism to the inner life of pirate organizations.

THE LIST

10 Most Important Handheld Devices of All Time

10 IBM DiskOnKey (2000)

Goodbye, floppy. Adios, Zip Drive! IBM's first flash drive model featured just 8MB of storage, which was several times the capacity of a floppy. And it fit in our pockets.

9 WALKMAN TPS-L2 (1979)

The boombox era officially died when Sony released the Walkman, which sported a metal case and not one, but two mini-jacks. Its cone of silence also enabled countless movie and TV murders in the early '80s.

8 Palm VII (1999)

This was the first truly wireless data/communication device, with a connection powered by a wireless antenna, the Mobitex network, and the $14.95 per month Palm.net service. We still have ours.

7 Canon 5D Mark II (2008)

Factor in a hot new image processor (DIGIC 4), a big, bright 21-megapixel sensor, and 1080p video capabilities so sophisticated that it was used to film an episode of TV's *House*, and you quite simply have one of the finest cameras ever produced.

6 iPad (2010)

Regardless of your thoughts about Apple, it's clear that the iPad is a bold, popular step into uncharted waters. It borrows from everything, but also projects a unique flavor that's caused a hell of an industry stir. There have always been a ton of "me too" devices in the consumer tech marketplace—this isn't one of them.

5 Harmony Remote Control (2001)

Zenith's Space Command may be the forefather of living-room remotes, but Harmony's initial series of universal remotes was an evolutionary leap. Even the very first model delivered Internet connectivity—further proof of a product that was more than slightly ahead of its time.

4 TEXAS INSTRUMENTS 'CAL TECH' (1967)

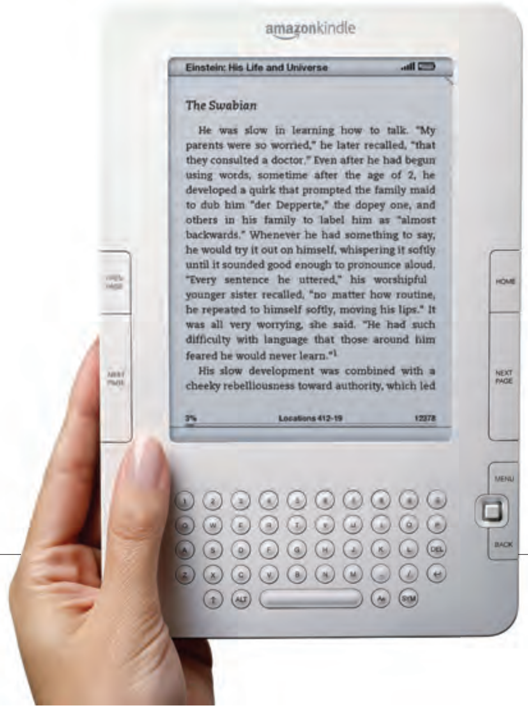
Invented by engineers who were still trying to find a home for the integrated circuit, the first handheld calculator known to man never surpassed the prototype stage and handled just the basics. "Cal Tech" was the foundation for the Canon Pocketronic and bazillions of handheld calculators afterwards.

3 iPhone 3G (2008)

The reason we've included the 3G version of the iPhone in this list has just as much to do with the concept that simultaneously debuted with it: the App Store, where boundaries are seemingly limited only by our imagination. Seven billion downloaded applications to date? Wow.

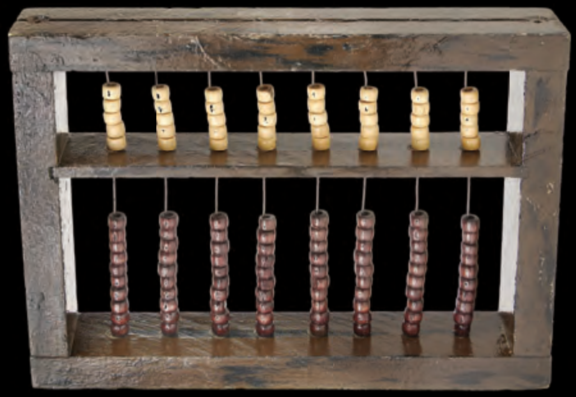
2 Amazon Kindle (2007)

The Kindle is so ubiquitous, and its impact on society so pronounced, that we can't believe it's only been commercially available for three years.



1 Abacus (600 B.C.)

Long before the smartphone or the laptop or the calculator—or the mechanical clock or even paper—there existed a handheld device that kept tabs on virtually anything involving numbers. That it's still in use today in various parts of the world, some 2000-plus years later, drives home its importance.



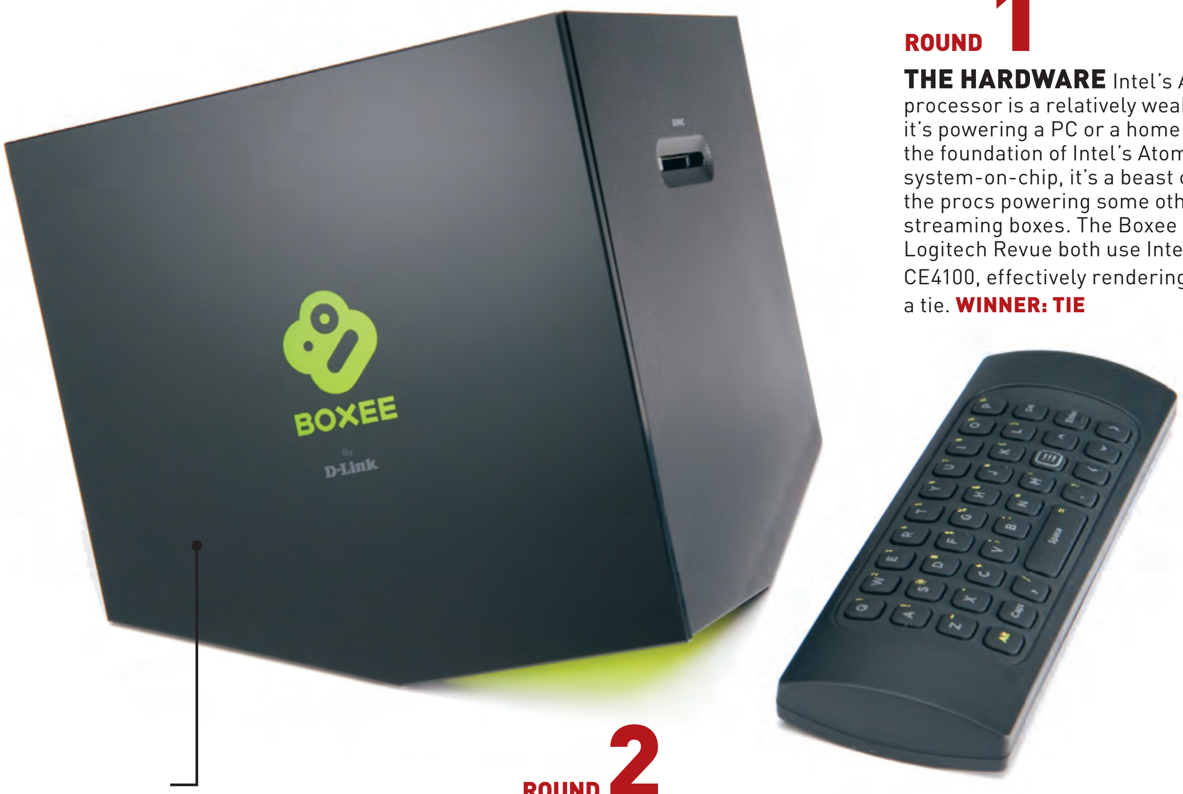
For our complete list of important handhelds, go to http://bit.ly/i3td2g.

DEATHMATCH

Boxee Box vs. Logitech Revue

The Internet is changing the way we consume TV programming in the most fundamental way since the invention of the DVR. Using websites operated by the major networks and video portals such as Hulu, we can watch our favorite programs whenever we want, not just when the networks decide to air them. And since the Internet is so wide open, we can enjoy independent video productions from around the world.

We can also share our TV-watching experience with friends and family using social networks such as Facebook and Twitter, we can broadcast our own productions using services such as YouTube, and we can watch our personal videos and photos on our TVs. But we need computing power to pull off the trick of integrating television, the Internet, and our own networks. D-Link's Boxee Box and Logitech's Google TV–powered Revue are two of the best alternatives to plopping a PC in your living room. We pitted the two devices against each other to find out which one delivers the best experience. —MICHAEL BROWN



D-Link Boxee Box
$200

ROUND 1

THE HARDWARE Intel's Atom processor is a relatively weak CPU when it's powering a PC or a home server. As the foundation of Intel's Atom CE4100 system-on-chip, it's a beast compared to the procs powering some other media-streaming boxes. The Boxee Box and the Logitech Revue both use Intel's Atom CE4100, effectively rendering this round a tie. **WINNER: TIE**

ROUND 2

THE REMOTE D-Link designed a wonderful compact remote control for the Boxee Box. It's about the size of a Hershey bar with a D-pad, play/pause, and menu buttons on one side. Flip it over and you're presented with a miniature QWERTY keyboard. It's a great design, but the lap-size keyboard Logitech bundles with the Revue is better. Given the choice between typing with two thumbs and typing with 10 fingers, we'll choose the bigger device every time. The same goes for a D-pad that moves the cursor in only four directions compared to a trackpad that moves it anywhere on the screen. What's more, the Revue's keyboard can control other hardware in your entertainment center; the Boxee Box remote works only with the Boxee Box. **WINNER: LOGITECH REVUE**

ROUND 3

WEB TV/LIVE TV INTEGRATION

If you're willing to wait for new episodes of your favorite TV show to make it to the web, the Boxee Box is a great solution. If you prefer to record your favorite TV shows to a DVR and watch them later, Logitech's Revue is far superior. Neither system works with CableCARD or over-the-air HDTV tuners, nor is either system self-contained when it comes to recording. The Boxee Box envisions a world where all TV programming streams from the Internet, but that world is a long way from reality. That leaves Logitech's Revue with a qualified win in this category.
WINNER: LOGITECH REVUE

ROUND 4

MEDIA SUPPORT As we wrote this comparison, Hulu and all the major television networks were actively blocking both the Boxee Box and the Revue from streaming video from their websites. The Boxee Box wasn't able to stream Netflix movies, either, but we'll take the developer at its word that Netflix, Hulu Plus, and Vudu will be available by the time you read this. The Revue ships with Netflix support, but Logitech hasn't said much about expanding its service offerings. If you're looking to stream movies you've ripped from disc, encoded, and stored on your network, the Boxee Box supports a much longer list of codecs. **WINNER: BOXEE BOX**

ROUND 5

PRICE/PERFORMANCE

The Revue is a more complex device than the Boxee Box. It overlays its GUI on live TV, is capable of controlling a Dish Network set-top box, and its remote can control other components in your entertainment center. While we realize that such sophisticated design costs money, it doesn't necessarily justify a price tag that's fully one-third higher than D-Link's product because the Boxee Box delivers several streaming services that the Revue doesn't. Logitech clearly needs to step up its game in this area.
WINNER: BOXEE BOX

Logitech Revue (Google TV) $300

And the Winner Is...

As much as we dislike declaring ties, that's where we find ourselves with the Boxee Box and the Logitech Revue (and by extension, Google TV). While there is common ground between the two, each platform is ultimately aimed at a different customer: The Revue is for people interested in watching their favorite TV programming, be it live or on the web; the Boxee Box is aimed at folks who are more interested in dumping their TV service provider and pulling everything from the Internet.

Ultimately, neither solution comes close to what a home-theater PC can offer. If you want the ultimate entertainment experience, buy or build a box with a Blu-ray drive and a CableCARD tuner. (Check out a video of George and Gordon building one at http://bit.ly/cFpTFD.) You'll get everything available through both of these systems and the networks will never be able to block you. It's an expensive solution, but it doesn't make any compromises. This Deathmatch is a draw.

less network when the microwave is running—and even then it will probably only slow down your wireless network, rather than knocking it out altogether. But for the best possible video-streaming experience, your best bet will always be a hardwired connection—either CAT5/CAT6 or power-line networking.

As for the best way to configure your power-line networking gear, you should plug one module into an electrical outlet near your router. Don't plug it into a surge suppressor, extension cord, or UPS. Hardwire that module to your router. The other PLN module should be plugged into an outlet near your Xbox (again, not into a surge protector, power strip, extension cord, or UPS) and connected to your Xbox via Ethernet cable.

Power-line networking gear won't work with surge suppressors because they filter the AC power and can cancel out the frequencies used to carry the data.

CMOS Virus or Hardware Failure?

My sister has an older Dell XPS machine using an Extreme Edition processor, 4GB of RAM, and a high-end Nvidia GPU. Everything was fine until yesterday, when it started acting up. The computer can no longer do two things at once without freezing or blue-screening. I cannot open My Computer without Explorer crashing.

I reformatted both of the hard drives, reseated the RAM, and dusted off the computer, yet it continues to blue-screen at random, inconsistent times. Do you think it's hardware? Or might it be a CMOS virus? Any input is welcome.

—Derek Frankovich

Viruses that reside in the CMOS are actually quite rare these days, but they do exist. It doesn't sound like that's what you have, though; it sounds more like a hardware issue. On older PCs, cooling, RAM, and the PSU are the first things to check. You've already cleaned it, so I'd consider running a memory tester on it. Memtest Plus (free from www.memtest.org) is where I'd start. Just download the ISO, burn it to a disc, and reboot to the disc on the PC. Let Memtest Plus do its thing. If the RAM passes, the next step is to start removing components from the board. If there's a soundcard or any other add-in card, start pulling them one at a time and trying to replicate the issue. If all of the add-in cards are pulled and you're still having problems, get a good flashlight and look into the case at the board. Check the capacitors on the board and see if any of them are bulged out. The board is unlikely to have bad caps, but it's worth a shot. On occasion, the Doc has seen thermal paste dry out enough to cause the processor to overheat, so also check the thermal paste on the CPU cooler and make sure the cooler is making firm contact.

SUBMIT YOUR QUESTION Are flames shooting out of the back of your rig? First, grab a fire extinguisher and douse the flames. Once the pyrotechnic display has fizzled, email the doctor at doctor@maximumpc.com for advice on how to solve your technological woes.

101 Websites to See Before *You Die!*

The finest wonders the web has to offer

BY ALEX CASTLE

We've done big website-extravaganza articles in the past, but this time we wanted to mix things up a bit. Rather than just focusing on what services are popular, or which web apps will make you the most productive, or which blogs are worth adding to your RSS feed, we wanted to take a look at what's fun on the Internet.

In that spirit, we're featuring 101 websites that you really must visit at least once in your lifetime. These are sites that will entertain you, educate you, or just plain blow your mind. They're not the kind of website you put in your bookmarks bar and come back to again and again—they're the kind that you email to your friends along with a note that says, "Holy s***, check this out!"

Where did the list come from? Well, half of it came from us, but 50 of them came from you, the readers, as part of a contest we held at MaximumPC.com. We're pumped about the reaction we got, so keep your eyes peeled for more opportunities to contribute to *Maximum PC* articles in the future.

zombo.com
Folic Acid
green tea
fish oil
cranberry
cocoa
cinnamon
probiotics
omega 6
Hmm, 12°C, Cloudy?
IT'S LIKE
ENDOR

WE CHOOSE THE MOON

Its name taken from John F. Kennedy's famous 1962 address to Rice University, this is an interactive history exhibit from NASA, allowing you to experience the Apollo 11 Mission, stage by stage. If you're a space buff and haven't seen We Choose the Moon yet, you need to drop everything and check it out, *stat*. **www.wechoosethemoon.org**

PERSONAS

An experiment from MIT's media lab, Personas takes your first and last name, scours the Internet, then spits out a composite image of what it thinks you're like, based on what it found about people with your name. Of course, unless you happen to have a completely unique name, you'll see data from lots of people other than yourself, but that's sort of the point. **personas.media.mit.edu**

WE FEEL FINE

Say what you will about the touchy-feely sentiment behind We Feel Fine, but the site is an interesting technological experiment in extracting data from the far-flung corners of the Internet. Just click the big pink heart for a swirling, up-to-the-minute graph of how everybody's feeling on the web. Click a particle to read about the feeling in context, and click that to visit the blog it came from. **www.wefeelfine.org**

SHAPE THE HIVE

What are humans, really, but so many bees buzzing away? That's the question (we think) asked by Shape the Hive, a visual "experiment in digital collaboration." In more concrete terms, Shape the Hive is a massive, color-coded hex grid, where anyone can use a sort of virtual kaleidoscope to fill in hexes with distorted images or videos. It's fun to have a look around, and easy if you're inclined to participate, so have a look. **www.shapethehive.com**

SOY TU AIRE

Don't let this page's Spanish intro throw you for a loop—you don't need to speak a word of it to appreciate the music and visuals contained here. Even if floating, lyrical melodies aren't your thing, stick with it to check out how the "ink" cursor effect changes to reflect what's going on in the song's lyrics. **soytuaire.labuat.com**

FALSE.JP

What we have here is a collection of simple visualizations (most respond only to the movement of your mouse cursor, and the left mouse button) from a Japanese graphic designer. You won't find any deep content on this page, but we suspect these mesmerizing visualizations will keep you entertained for longer than you'd like to admit. **www.false.jp**

AKINATOR

When you were a kid, did you ever play 20 questions? You know, where you think of a person, place, or thing, and then your friend gets to ask 20 yes-or-no questions to figure out what it is? Well, it turns out that 20 questions is one of those games, like checkers, that's better played by computers. Think of any character at all, from a movie, TV show, game—anything. Then just answer Akinator's questions to the best of your ability. No guarantees, but we think you'll be impressed. **us.akinator.com**

THE DIONAEA HOUSE

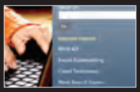
The Dionaea House is an example of "hyperfiction," a story told through more than just a single running narrative. A bit like an alternate-reality game

More Awesome Sites

graphjam.memebase.com

www.sealandgov.org

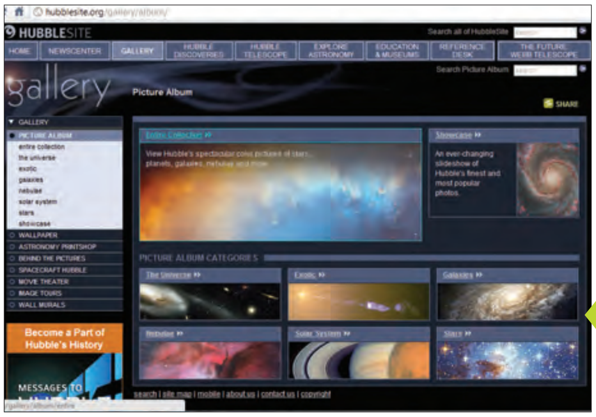
htwins.net/scale



www.wordle.net

theoatmeal.com

marriedtothesea.com



It took Hubblesite to make us truly appreciate nebulae.

minus the reader participation, "reading" The Dionaea House involves following a number of threads on different blogs and in comments. We won't tell you anything about what The Dionaea House is actually *about*, because discovering that is the fun part.
www.dionaea-house.com

LINE RIDER

For some, Line Rider is a canvas. For others, it's a way of life. But for most, Line Rider is just a flash game where you draw out a course for a little sledder guy to ride on. It's a kick, and something everyone should try, if for no other reason than to understand the effort it takes to make the kind of Line Rider videos that get passed around on sites like Reddit and Digg.
www.linerider.com

PRETTY LOADED

Flash technology has allowed for a boom of rich media on the web, but it's brought its share of problems as well. One such problem is the vile loading period, keeping you from enjoying your web content or video game. Thankfully, some designers realize that it's important to keep users engaged during this period, and have elevated the preloader progress bar to an art form. Pretty Loaded celebrates these unsung heroes of web development, showcasing the very best of preloaders from around the web.
www.prettyloaded.com

ANASOMNIA

The first thing that's amazing about Anasomnia: the densely packed, surreal dreamscape animations that only play when the lights in your room are out (although you can trick it if you cover up your webcam with your hand). The second thing that's amazing about Anasomnia: Every dream is different. Through some sort of procedural-generation trickery, Anasomnia will be a different show every time you turn your lights off.
www.anasomnia.com

STATE OF THE UNION

Sure, the annual State of the Union address might seem a little dry to make into an afternoon time killer, but that's exactly what this site does, with data visualizations, statistical analysis, and searchable texts of every single address. History and politics have never been as addictive as this.
www.stateoftheunion.onetwothree.net

HUBBLESITE

Sometimes, you need to be reminded that—no matter how big your personal problems might seem—you're just an insignificant mote in an unfathomably large universe. Other times, you just want to see kick-ass images from the most righteous piece of optics we've ever blasted into the cosmos. In either case, Hubblesite.org has you covered.
www.hubblesite.org

EYEZMAZE

EyezMaze may not sound familiar to you, but if you're a fan of browser games you've probably played one of the site's Internet-famous GROW series. If you haven't, you should check it out right away. The basic conceit is this: You have to place a set number of elements into a scene, in a certain order. The order matters, so you have to follow the clues in the impossibly charming animations to figure out the optimal order and win the game. We recommend you start with GROW v.3.
www.eyezmaze.com

PSYCH!

Four Web-Based Practical Jokes

BSOD

Load this page on someone's browser, and hit f11 to enter full-screen mode. Bonus points if they have an unsaved document open when you do it. www.mcdlr.com/bsod

MAKE YOUR OWN ERROR MESSAGE

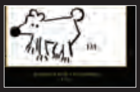
This simple app lets you write your own error messages. Take a screenshot and send it to your IT department (if, that is, you don't value your life). atom.smasher.org/error

INTERNET EXPLORER 6

Just send this link to someone, and they'll get to relive the glory days of Internet Explorer 6. http://mrdoob.com/lab/javascript/effects/ie6/

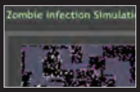
LET ME GOOGLE THAT FOR YOU

A truly brilliant web-burn, LMGTFY.com delivers a one-two punch of snark and technological superiority to anyone stupid or unfortunate enough to ask you for help online. Pro tip: Combine with a URL shortener like bit.ly for extra effectiveness.
www.lmgtfy.com

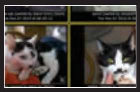


alpha61.com/primenumbershittingbear

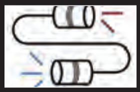
www.dontevenreply.com



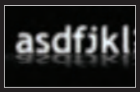
kevan.org/proce55ing/zombies



www.catsthatlooklikehitler.com/cgi-bin/seigmiaow.pl



www.twocansandstring.com



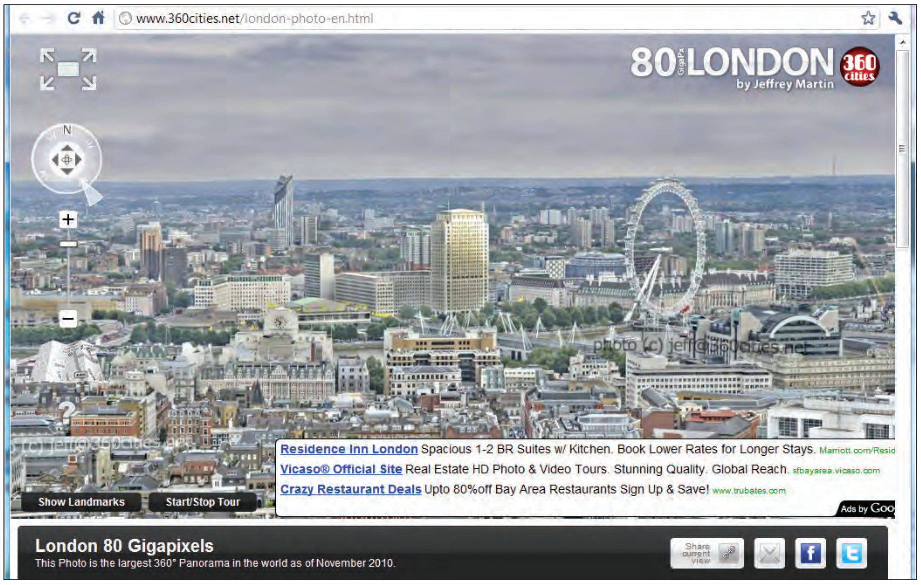
www.asdfjklsemicolon.com

BLU

If you're in the kind of mood to have your mind blown, allow us to suggest a visit to the website of the street-artist BLU. Street art like graffiti? Sort of, but in motion. Check out the Video tab on the BLU website for a collection of four stop-motion street animations that are as insane as they are long. To see the craziest one first, start with "Big Bang Big Boom."
www.blublu.org

MR. WONG'S SOUP'PARTMENTS

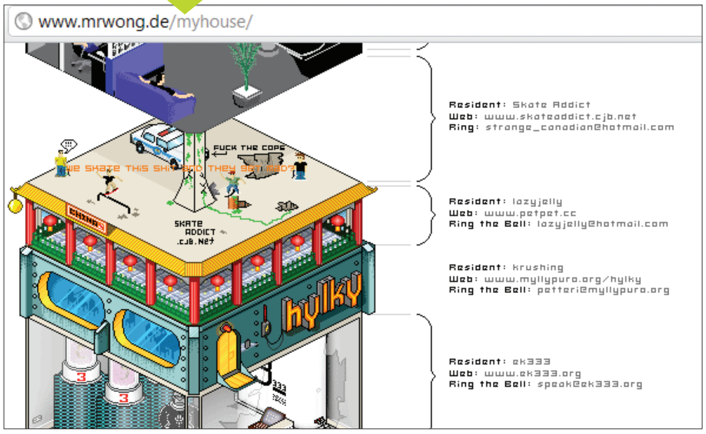
In another testament to the fact that nobody wastes time as spectacularly as hundreds of people wasting time together, Mr. Wong's Soup'Parments is a collaborative pixel-art image of a tower—each individual floor drawn and submitted by a different person. The final product is the "world's tallest virtual building" and a great way to kill a few minutes. Prepare to wear out that scroll wheel!
www.mrwong.de/myhouse



You won't believe the size and detail of this digital panorama!

80 GIGAPIXEL LONDON

It can be hard to keep up with who's currently winning the "world's largest photo" race, but right now the king is a 360-degree panorama of London. Clocking in at 80 gigapixels (that's 8,000 times the resolution of your average point-and-shoot camera, for reference), this panorama is detailed enough to read the license plate on a faraway bus.
www.360cities.net/london-photo-en.html



A multitude of personalities combine in one towering building.

BLUE BALL MACHINE

Another example of community-driven pixel art, the Blue Ball Machine consists of tiled animated gifs representing the Rube Goldberg–esque workings of a giant blue-ball-processing facility. Originally spawned as part of a challenge on the Something Awful forums, the first Blue Ball Machine image became a popular YTMND site, and inspired a number of follow-ups.
blueballfixed.ytmnd.com

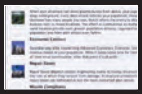
THE MILLION DOLLAR HOMEPAGE

The Million Dollar Homepage contains only a single image. That image is a giant, ugly, expensive advertisement. And that giant, ugly advertisement made some college kid in the UK one *million* dollars. The idea is simple: Create a 1,000,000 pixel image, and sell those pixels off for a dollar each (in blocks of 100). People are free to use those pixels to advertise and link to whatever they want (online casinos and scams mostly, it seems). Every single pixel sold out, and Alex Tew of Wilshire England made a cool mill. How could he make so much off of something so dumb? Because he thought of it first.
www.milliondollarhomepage.com

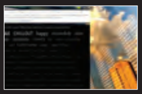
WAYBACK MACHINE

There's no greater tool for exploring Internet history than the Wayback Machine. Simply put, the site will take any URL, and create a gallery of historical versions of that website for you to explore. Check out some of your favorite websites, and marvel at how far we've come in just five or 10 years.
www.archive.org/web/web.php

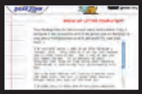
More Awesome Sites

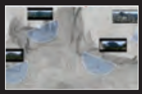

lab.wx3.com/defender

moodstream.gettyimages.com


stereomood.com

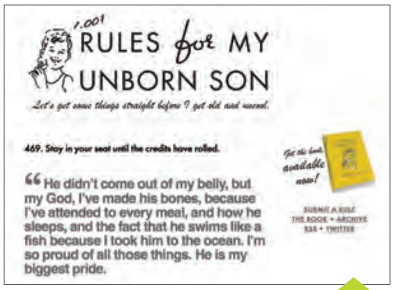
www.phonespell.org/phonespell.html


www.dearjohn.com/generate.php


www.xrez.com/yose_proj/yose_deepzoom/index.html

CLEVERBOT

You can't call yourself a true connoisseur of Internet curios until you've attempted to have a full-fledged conversation with a chatbot. People have been trying to make convincing chatbots since the '70s, and even though we're still far from something that'll pass the Turing Test, it can be a real kick to try talking to one of these. Like its predecessor Jabberwacky, Cleverbot learns more with each conversation it has. After you've fooled around for a while, check out the "cleverness" section for a collection of funny or impressive conversations between Cleverbot and other people. **www.cleverbot.com**

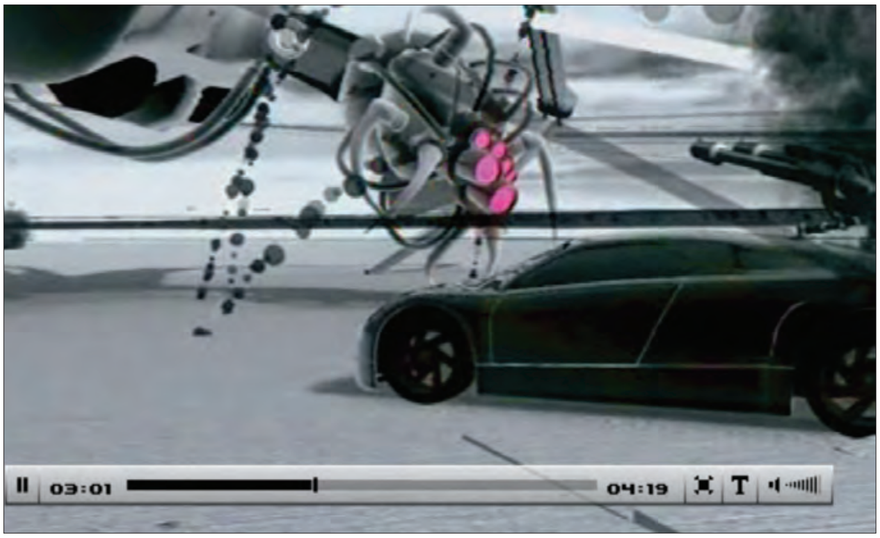


RULES FOR MY UNBORN SON

For the most part, our list of websites is free of blogs, because—by their very nature—they're not really a single-serving kind of thing. All the same, Rules for My Unborn Son has been regularly updated for long enough that pretty much anyone can get a healthy dose of awesome advice just by spending an hour or two paging through the archives. **www.rulesformyunbornson.tumblr.com**

DEMOSCENE.TV

If you're not familiar with the demoscene, here's what you need to know: There's a subset of computer programs, musicians, and artists who engage in competitions to fit the most impressive and extravagant visual displays (and sometimes even games) into teeny-tiny chunks of script. We're talking whole music videos crammed down into 64K or smaller. At Demoscene.tv, you can get a feel for what the demoscene is all about without having to run any strange code on your computer—all the demos are streamed, à la YouTube. **www.demoscene.tv**



THE PERRY BIBLE FELLOWSHIP

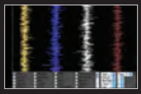
One of the few truly classic webcomics, The Perry Bible Fellowship is a pitch-perfect mixture of whimsical art, extra-dark humor, and good, old-fashioned surrealism. The author Nicholas Gurewitch still updates sporadically, but you can absorb the whole archive in one sitting (if you've got an afternoon to spare). **www.pbfcomics.sciesnet.net**

DESKTOP TOWER DEFENSE

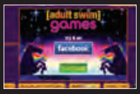
You're not going to find any shortage of flash games in the Tower Defense genre online, but Desktop Tower Defense is the classic. It's an open-field-style tower defense, so you have to create and update a maze of defensive structures to fight off wave after wave of bad guys. Careful—*very* addictive. **www.handdrawngames.com**

More Awesome Sites

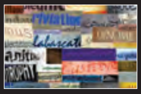
inception.davepedu.com


enigmasand.com

webdocs.cs.ualberta.ca/~chinook/play/index.html


games.adultswim.com/robot-unicorn-attack-twitchy-online-game.html

www.deathball.net/notpron


savethewords.org

GLOBE GENIE

If you ask us, the coolest thing about Google Maps is the street view, which allows you to get a like-you're-really-there 360-degree view of any location that Google's vans have trawled. It's an awesome way to get some perspective on places you've never been, but it can be hard to choose where you want to "visit."

Globe Genie takes the work out your Google Maps globetrotting. Just select which continents you'd like in the running, and then click the Teleport button. For added fun, uncheck the Current Location button and try to guess what country you're in based on just your surroundings. **web.mit.edu/~jmcmicha/www/globegenie**

ZOMBO.COM

What is Zombo.com? You can do anything at Zombo.com. **www.zombo.com**

LET'S PLAY ARCHIVE

Ever wanted to know what all the fuss about a game is, but don't have the time or willpower to actually play it? Head to the Let's Play Archive, where you can check out tons of archived "let's play" threads from the Something Awful forum—where people post guided walkthroughs of video games, frequently accompanied by hilarious commentary and illustrations. **www.lparchive.org/LetsPlay**

TV TROPES

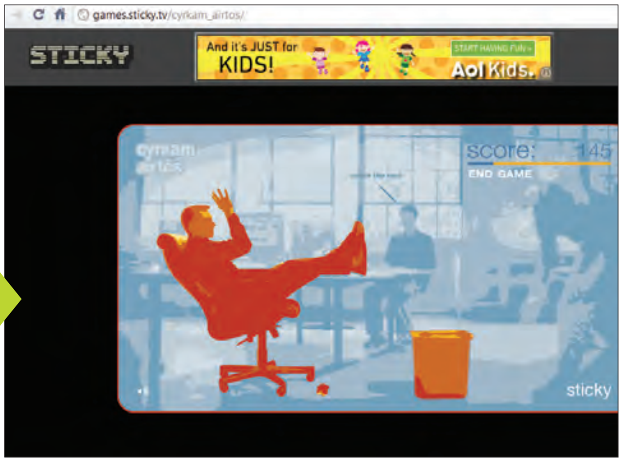
You might check out TV Tropes and think, "Hey, this isn't a single-serving site, this is an amazing resource that I'll come back to again and again!" Well it's not. The diabolic thing about TV Tropes is that any actual utility is an illusion—your life will never be enriched because you know what a Woobie is, or who the members of a Five Man Band are. It's an elaborately designed trap, meant to capture all your free time. Therefore, go once, waste a day, and then never look back. You'll thank us later. **www.tvtropes.org**

AUTOTOPSY

Who knew an educational site about auto insurance could be so interesting? In this dramatic simulation, you tag along as an insurance company investigator surveys the scene of a horrific accident. Surprisingly solid visual effects and live-action cutscenes combine to give you an entertaining look into the way insurance companies determine who gets paid and who doesn't. **www.autotopsy.ca**

CYRKAM AIRTÖS

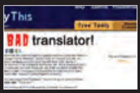
What happens when you take a normal time-killing activity and turn it into a flash time-killer? You get a veritable vortex of time-killing—a vortex named Cyrkam Airtös. If you haven't played it before, Cyrkam Airtös is a surpris-



Tossing crumpled trash into a can has never been so addictive.

More Awesome Sites

www.amiblind.com



www.conveythis.com/translation.php

www.kongregate.com/games/IcyLime/multitask

firstpersontetris.com

periodictable.com

armorgames.com/play/4309/this-is-the-only-level

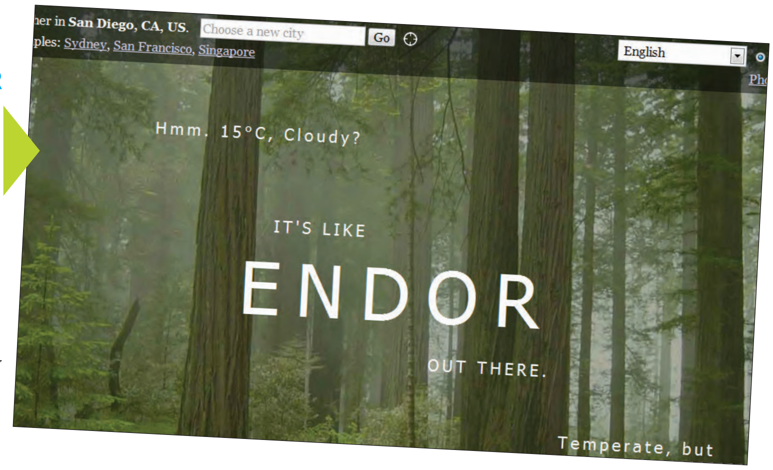
ingly challenging flash game about tossing crumpled-up paper into a garbage can. Sounds easy? Give it a try and tell us your high score. **www.sticky.tv/game/cyrkam_airtos/**

CRIMSON ROOM

The premise of Crimson Room is simple: You're in a room, it's crimson, and you're trying to escape. You'll have to make use of everything in your environment and solve some seriously fiendish puzzles to get out. Crimson Room was so well received that it spawned an entire genre of "escape the room" adventures that now includes dozens of games. **www.fasco-csc.com/works/crimson/crimson_e.php**

STAR WARS WEATHER

We've had about enough of weather websites that just tell you boring, useless details like the "temperature" and the "humidity" and "whether or not it will rain." Star Wars Weather cuts through all the BS and tells you what you really want to know: what *Star Wars* planet the weather outside most closely resembles right now. **www.tomscott.com/weather/starwars**



Whevever you are, the weather is just like it is on a *Star Wars* planet.

GOOGLE BUILDING MAKER

Google's built a lot of cool tools and toys over the years, but for sheer "oh, neat" value, this one's our favorite. The Google Building Maker allows you to pick a building from any of dozens of cities, and build a 3D model of it. If your model is any good, it'll even get displayed for everyone to see on Google Earth.

What's that you say? "I don't know how to make 3D Models." Well, that's the real beauty of this site—it makes it so easy that anyone can do it, and it's fun. Give it a try—we think you'll have a hard time stopping after just one building. **sketchup.google.com/3dwh/buildingmaker.html**

THE BEST PAGE IN THE UNIVERSE

As much as anything on the Internet can be considered "old school," The Best Page in

MEME STARTERS!

Visit the Origins of Some Classic Memes

YOU'RE THE MAN NOW DOG

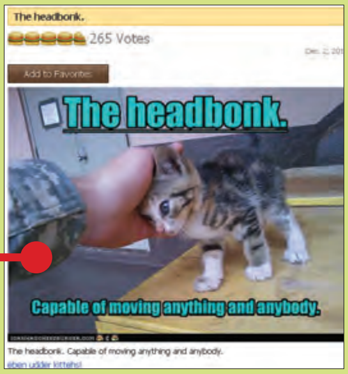
www.yourethemannowdog.com
Meme started: YTMND

WILL IT BLEND?

www.willitblend.com
Meme started: "But will it blend?"

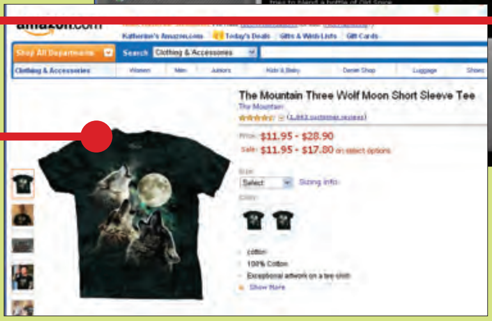
I CAN HAZ CHEESEBURGER

www.icanhascheezburger.com
Meme popularized: LOL Cats

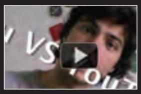


THREE WOLF MOON AMAZON PAGE

http://amzn.to/7whhld
Meme started: Three Wolf Moon



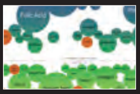
www.kongregate.com/games/Pastelgames/the-trader-of-stories



www.youtube.com/trivialpursuit

www.virtual-bubblewrap.com

www.verbatim.jp/senshuken



www.informationisbeautiful.net/play/snake-oil-supplements

failblog.org

the Universe (better known as the home of Maddox's epic rants) fits that bill. Online and semi-regularly updated since 1997, anyone who's been on the Internet should have visited it at least once by now. If you haven't, now's the time to catch up on some comedy and net history.
maddox.xmission.com

TED'S CAVING PAGE
Older than The Dionaea House, and less intricately constructed, Ted's Caving Page is nonetheless a marvelously creepy example of how to tell a story well on the Internet. Like the previous example, the less you know about Ted's experience in the cave the better, but let's just say that those who are claustrophobic or afraid of the dark might want to avoid this one.
www.angelfire.com/trek/caver

THE F***ING WEATHER
OK, so *Star Wars* isn't your thing. We've still got you covered. In the same vein as whatthefuckshouldimakefordinner.com, www.thefuckingweather.com gives you just the facts about the weather—and it doesn't sugarcoat them. NSFW if someone in your office is offended by large, Times New Roman profanity.
www.thefuckingweather.com

I LOVE BEES
I Love Bees was not the first ARG (alternate reality game) or the last, but it was definitely the largest and most well publicized. Designed as marketing for Halo 2, it's way too late to participate in the sci-fi mystery, but you can still visit the site's original entry point www.ilovebees.com for a bit of Internet history. If you want to know more about the I Love Bees story, check out its entry on the Halopedia.
www.ilovebees.com

HERO MACHINE
A Time-waster with a capitol T, the Hero Machine lets you put together comic-book-style superheroes from an astonishingly large list of possible parts. You can try to make the coolest hero possible, or you can just hit the Random button until you find something that makes you laugh.
www.ugo.com/games/superhero-generator-heromachine-2-5

PHOTOSYNTH
Photosynth is a project from Microsoft that allows you to take collections of digital photos and stitch them together into a kind of 3D panorama. Unlike a normal panorama, which is a large, flat image, in a Photosynth you can move through the scene and see objects from different angles. There's an enormous gallery of user-submitted Photosynths to browse through, and more are added every day.
www.photosynth.net

MUSIC IN MOTION

5 Sites to Change the Way You Look at Music

RECORD TRIPPING
A seriously cool, seriously inventive game that pairs wheel-turning puzzles, record scratching, and Alice in Wonderland. The whole thing's played with just the scroll wheel and the left mouse button, so assuming you've got both of those, head on over.
www.recordtripping.com

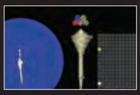
INCREDIBOX
Incredibox is an awesomely executed music-creation web app that lets you create your own a capella groove by clicking and dragging different parts onto a lineup of cartoon Frenchmen. OK, it's hard to explain—just try it out.
www.incredibox.fr

THE WILDERNESS DOWNTOWN
The Wilderness Downtown is collaboration between Arcade Fire, director Chris Milk, and Google. Even if you're not a fan of the music, it's worth checking out as a technology demo for HTML 5 from some of the crack engineers at Google.
www.thewildernessdowntown.com

BALL DROPPINGS
In Ball Droppings, a steady stream of little white balls fall from the top of the screen and bounce off of walls that you draw with your mouse. Each bounce creates a tone, so drawing the perfect maze creates a hypnotic audio-visual experience.
www.balldroppings.com/js

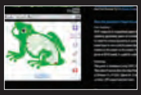
DORITOS LATE NIGHT
An oddly high-quality production from Doritos, this site houses a collection of music videos in 360-degree surround video. That means you can turn around and view any part of your surroundings at any time, like Google Street View.
www.doritoslatenight.com

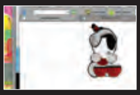
More Awesome Sites


seaquence.org

www.kokogiak.com/megapenny

www.chromeexperiments.com


experiments.instrum3nt.com/markmahoney/ball/#


www.tokyoplastic.com/dm.html

informationisbeautiful.net

Great-Looking Games

Five online games with great visual style

GET THE GLASS

We're not the biggest fans of blurring the line between advertisement and gaming, but we're willing to make exceptions in two instances: 1) When it comes to frosty, delicious milk. 2) When the game in question is a beautifully imagined and well thought-out virtual board game, with graphics that still look amazing three years after the fact.

And what do you know—Get the Glass succeeds on both of those counts! It's almost like we planned it that way.

www.gettheglass.com

ORGAN TRAIL

Organ trail is a lot like the classic edu-tainment title Oregon Trail, but with one key difference: zombies. Aside from the introduction of the flesh-eating horde, the game plays very much like the original, as it absolutely nails the 8-bit look.

So, stock up on medical kits and spare mufflers, hop in the station wagon, and try and make your way to the end of the Organ Trail.

www.hatsproductions.com/organtrail.html

HOTEL 626

Yet another Doritos-related site, Hotel626 is a decidedly non-snack-related horror puzzle game, which challenges you to escape from a haunted hotel while solving challenges and avoiding an untimely demise. The puzzles aren't going to thrill seasoned adventure gamers, but the overall production value is impressive, as is the novel use of elements like your webcam, microphone, and even your cell phone.

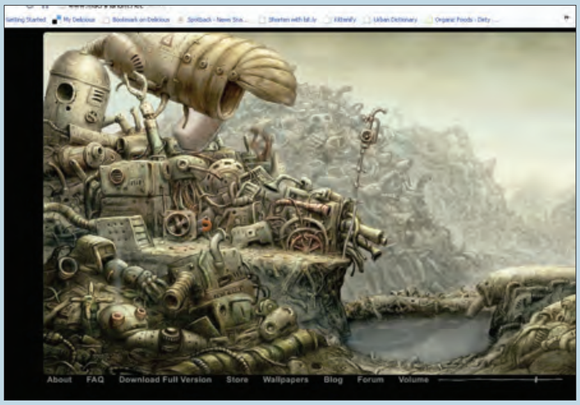
One thing though: You can only play the game at night. (If you're sneaky, you might try changing your system clock to sometime after 6pm).

www.hotel626.com

MACHINARIUM

The full version of Machinarium is available for purchase on Steam, but the demo is still an amazing example of the kind of things that can be done in Flash. With its combination of stunning, hand-painted graphics and fiendish puzzles, this game is a must-play for any adventure-game fan. Fair warning: You're going to have a hard time not buying the full version.

www.machinarium.net/demo



AUDITORIUM

Halfway between a physics puzzle game and a Winamp-style visualization, Auditorium manages to strike a great balance between beautiful, colorful graphics and gameplay that's actually fun and challenging.

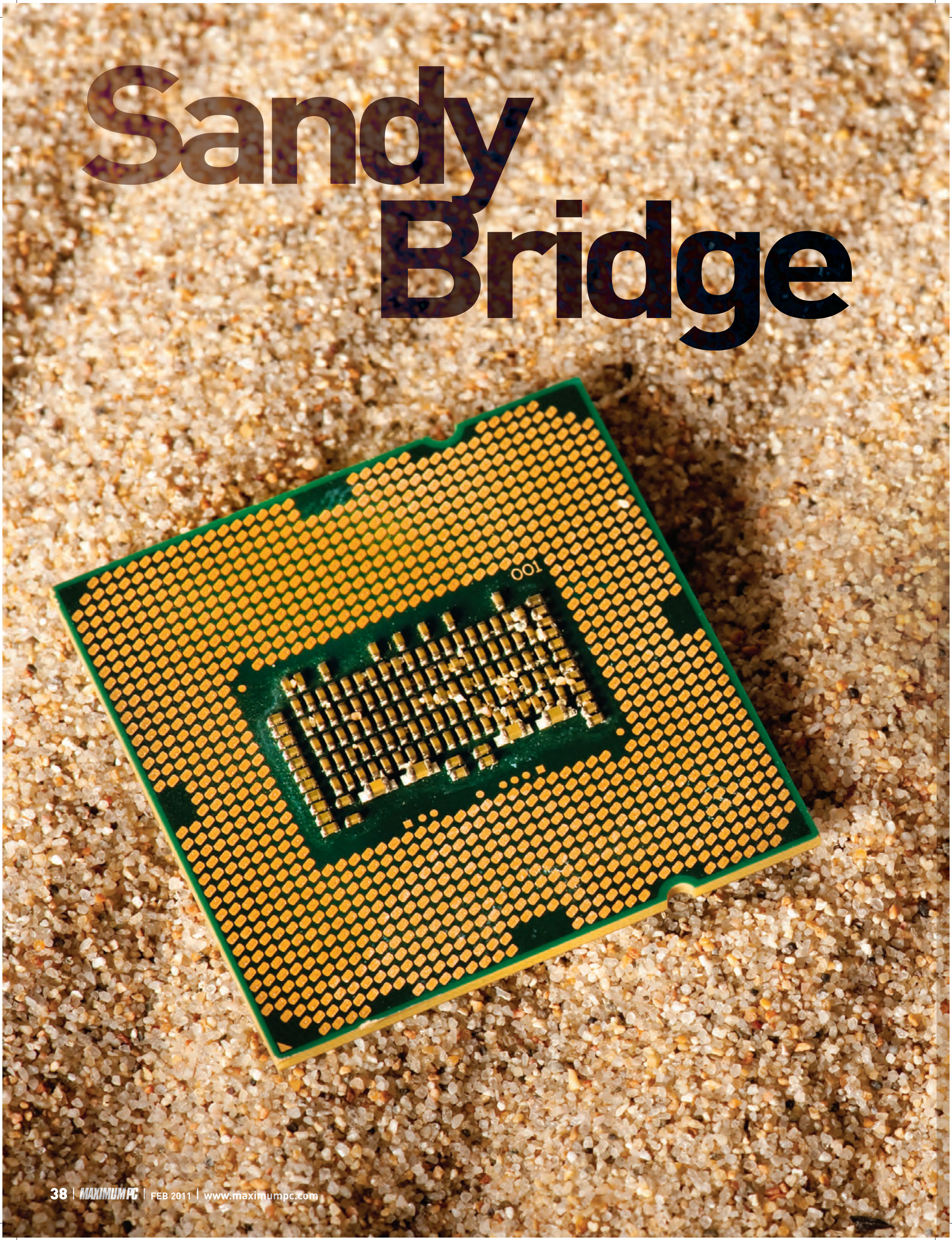
Don't give up on the game after the first few levels—it gets more challenging and engaging starting in the second set of levels.

www.playauditorium.com

CHECK IT OUT ONLINE!

For more information and direct links to these awesome websites, go to **http://bit.ly/eBk8rq.**

Sandy Bridge



Washes Ashore

All other processors cease to matter in the wake of Intel's new high-performance CPU

BY GORDON MAH UNG

When your only competition is yourself, what do you do when you have to introduce your latest and greatest CPU? Commit fratricide against your own chips? If you have the muscle and war chest of Intel, then yes.

At least, that's what Intel's new Sandy Bridge CPU family does to the company's existing lineup of processors—lines them up on a cliff and pushes them off, one by one.

The stellar Core i7-870? Off you go. Core i7-975 Extreme Edition? Who needs your luxury-priced ass, anyway? Core i7-950? We'll see you in hell!

In essence, Intel's Sandy Bridge has rendered all previous quad-core and dual-core processors obsolete in both performance and price. Yes, the top chips in Intel's Sandy Bridge family are that fast. And they're pretty damn cheap, too. The fastest Sandy Bridge chip, for example, will outrun the $1,000 Core i7-975 Extreme Edition, yet it costs just three bills.

Sandy Bridge isn't just about performance, though. It's the first time Intel will integrate a graphics core into all of its CPUs. And perhaps in its most controversial move, Intel will also finally put a nail in the coffin of overclocking for average folks. To find out whether overclocking is really dead, how fast Sandy Bridge is, and whether graphics are now suddenly important, flip the page.

SANDY BRIDGE CPU COMPARISON

	3.4GHZ CORE I7-2600K	3.3GHZ CORE I5-2500K	3.1GHZ CORE I5-2400	2.93GHZ CORE I3-2100
Turbo Speed	3.8GHz	3.7GHz	3.4GHz	2.93GHz
Cores / Threads	4 / 8	4 / 4	4 / 4	2 / 4
RAM Support	DDR3/1333	DDR3/1333	DDR3/1333	DDR3/1333
Graphics Clock	3,000MHz	3,000MHz	2,000MHz	2,000MHz
L3 Cache	8MB	6MB	6MB	3MB
Socket	LGA1155	LGA1155	LGA1155	LGA1155
TDP	95 watts	95 watts	95 watts	65 watts
Process	32nm	32nm	32nm	32nm
Die Size	216mm²	216mm²	216mm²	131mm²
Transistor Count	995	995	995	504
Bulk Price	$317	$216	$184	$117

TALKING THE TOCK

If you're not up on current events, Intel has followed a "tick-tock" cadence in its chip making these last few years. A "tock" represents the huge, sweeping changes to processor microarchitecture that we all get hot under the collar for. That's eventually followed up with a tick, or more minor improvements to the existing microarchitecture.

One well-known tock was the original Core 2 "Conroe," which literally saved Intel's bacon and finally put that bad nightmare of a microarchitecture known as Netburst in its grave. Another tock was the Core i7 "Nehalem." It was a revolutionary step for Intel wherein the memory controller got integrated into the die and the ancient front-side bus was jettisoned.

So, what's so special about Sandy Bridge that it earns the distinction of being a tock? It's hard for us to single out just one quality, but certainly a key feature is the fully integrated graphics core. With Sandy Bridge, Intel has completed its commingling of graphics and compute processing by moving an improved graphics core directly into the 32nm die. Intel had previously integrated a separate 45nm graphics core inside the CPU of its Clarkdale (and mobile Arrandale) chips, but it was a bit of a hack. Since the GPU is now integrated in the die, all second-generation Core i3/5/7 CPUs will include graphics—so no more of that some-chips-get-graphics-and-some-don't hullabaloo that happened with LGA1156-based CPUs.

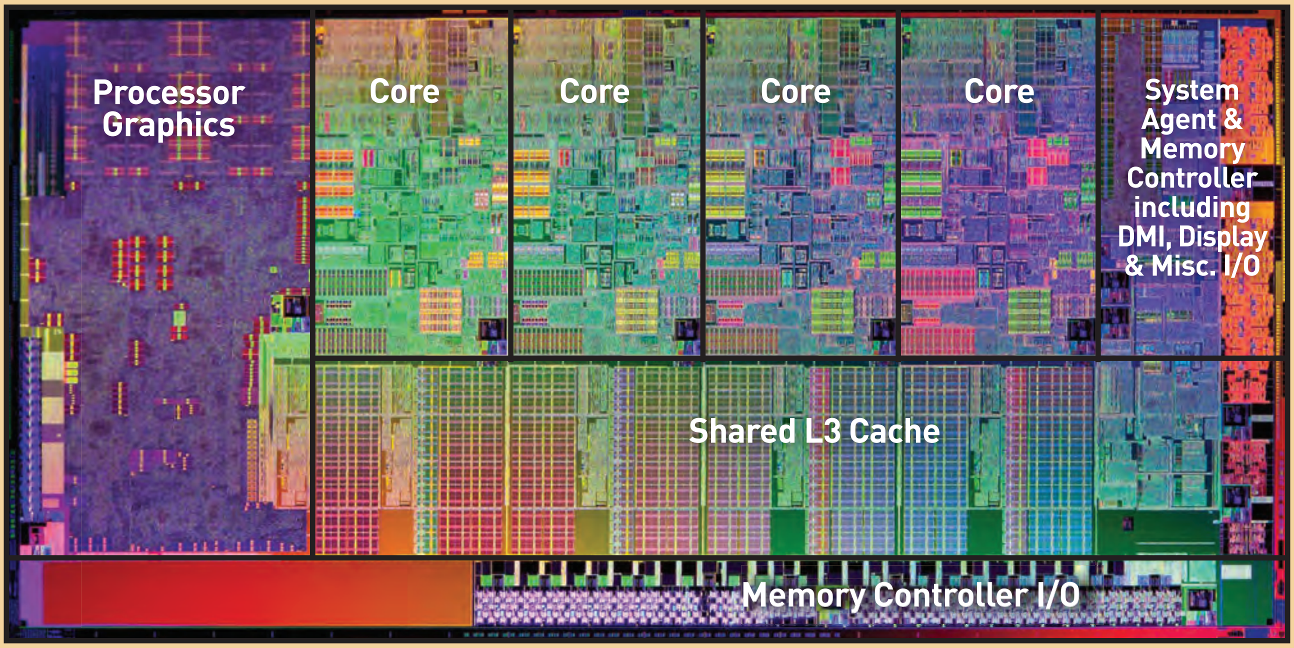
Sandy Bridge represents a far more elegant integration of graphics, and some would argue that Intel has beaten AMD to the Fusion punch by pushing its parts out first. Intel even designed a new ring bus that services the graphics processor and the x86 cores and L3 cache. Besides offering boatloads more bandwidth than the previous iteration, the ring bus allows

UNDER THE HEAT SPREADER

The Sandy Bridge Architecture up Close

Sandy Bridge is a vast improvement over the previous Clarkdale/Arrandale-based Core i3 and Core i5 chips. Previous Core i3 and i5 CPUs used a multichip package joined by a fast QPI connection inside the heat spreader. Every Sandy Bridge chip uses the same monolithic die that includes an elegant layout of a "processor graphics" core alongside two or four cores and a fat load of L3 cache. To join all of these together, Intel has designed a new ring bus that offers a phenomenal amount of bandwidth to all of the parts.

The bandwidth varies based on the number of cores on the ring bus and the clock speed. That's because the L3 cache now runs at full core-clock speed. Previously, the L3 cache ran at the lower "uncore" speed. In a typical quad-core Sandy Bridge chip running at 3GHz, roughly 384GB/s of bandwidth is available from the L3 cache. As with Lynnfield and Clarkdale, an integrated memory controller and a single x16 PCI-E 2.0 is embedded in the core as well. The connection to the peripheral control hub, which we call the south bridge, comes via a single 20Gb/s Direct Media Interface connection.



the L3 cache to run at the clock speed of the CPU. Previously, the L3 cache was included in the "uncore" part of Nehalem that was clocked down. These higher clocks, obviously, increase bandwidth and reduce latency.

The x86 cores themselves are evolutionary developments of the Westmere design, so all chips now get encryption/decryption acceleration care of the AES-NI instructions. One key change is the addition of Intel's Advanced Vector Extensions, or AVX. AVX instructions are designed to vastly improve floating-point performance across the board for the increasingly media-rich world we live in. AMD also has plans to support AVX in its upcoming Bulldozer chip, so AVX instructions are a shoe-in for support. However, as always, specialized instructions take time to flourish. At press time, we couldn't find any AVX-enabled applications, and full OS support for AVX won't happen until Microsoft releases Service Pack 1 for Windows 7.

GRAPHICS: GOOD BUT NOT GREAT

You know you're in bizarro-world when one of the most touted features of Sandy Bridge isn't an x86 innovation, but the integration of a graphics core. While Intel once pooh-poohed GPU-accelerated encoding as pure suckage, it's a check-off feature on Sandy Bridge that the company is quite proud of. Some folks might snicker at this, but we doubt that Nvidia and AMD are very amused, as Intel has a history of enacting 180-degree spins with a technological vengeance. Think of the original Core 2 or the Core i7. Both represented healthy portions of crow-eating by Intel, but both chips were also untouched by rivals for years.

While the graphics in Sandy Bridge are certainly improved, don't expect miracles. If you want Warcraft or Starcraft at standard resolutions without shelling out $75 for a discrete GPU, then Sandy Bridge might work for you.

Graphics aren't just about gaming, however. The new graphics core, when combined with a chipset that supports video output ports (the H67 and Q67 chipsets), will support Blu-ray 3D output over HDMI 1.4a, more video-processing options to enhance playback, and for laptops equipped with Wireless Display, full 1080p to a WiDi adapter hooked up to your TV. Intel's graphics-based encoding/transcoding is called Quick Sync Video. Quick Sync Video is building support, but it has the drawback of being incompatible with a discrete graphics card. The onboard graphics core is disabled with discrete graphics, becoming, essentially, a waste of transistors. Ideally, we would like to see switchable graphics on the desktop that let you turn off the power-hungry ATI or Nvidia card when you don't need it and instead use the power-sipping Sandy Bridge chip. This is done on notebooks, so why not on desktops?

The upshot regarding the new, improved graphics in Sandy Bridge is, temper your expectations. For an HTPC not intended for gaming, it's a great solution. For your mom's machine, more than enough. For you? *Fuhgettaboutit*.

TURBO BOOST MADE BETTER

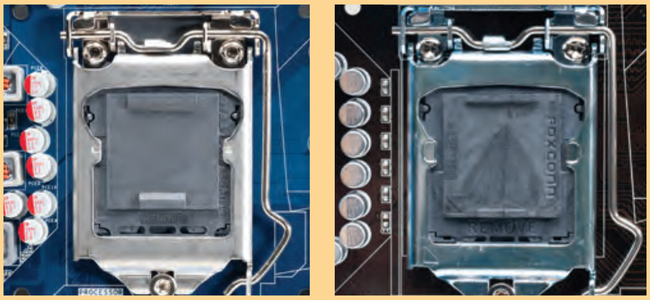
Although there are numerous sources for the performance enhancements in Sandy Bridge, Turbo Boost 2.0 deserves special mention. Intel has been refining its automatic-overclock feature for years, and Sandy Bridge shows the confidence Intel now has in its silicon and how far it can be pushed. Older versions of Turbo Boost would "turbo up" but not if all the cores were being pushed. The best results from Turbo Boost came in lightly threaded applications that hit just one or two of the cores. Turbo Boost 2.0 will throttle up even if all four cores are under load. The boost will only drop off if the chip's power control unit senses that it's near overheating. Desktop parts get a healthy

LGA1155

One Socket to Rule Them All?

We've been warning readers that LGA1156 was a dead man walking for months now. Well, meet its replacement: LGA1155. Yup, just one pin and your board is officially obsolete. With LGA1155, Intel is introducing four new chipsets, with only two that matter to you: H67 and P67. There's no native USB 3.0, but SATA 6Gb/s is now supported on up to two ports of the south bridge—support on all the ports would be too costly. The key differences between the two chipsets is that H67 offers support for the internal graphics, and overclocking will only work on P67.

One big question is whether LGA1155 will exist only for Sandy Bridge. There have been rumors of moving the new Xeon socket LGA2011, with its quad-channel memory, to consumers later this year, but we understand that Intel is now considering going back to a single-socket lineup. LGA1366 will be supported with updates this year, but after that, LGA1155 could be the only game in town.



On the left is the old LGA1156 and on the right is the new LGA1155.

dose of boost—the top-end 3.4GHz Core i7-2600K will clock up to 3.8GHz—but mobile gets a bigger shot. The 2.5GHz Core i7-2920XM, for example, will boost all four cores up to 3.2GHz. A single-threaded app on the same chip could see the CPU boosted up to 3.5GHz—that's a 1GHz overclock in a notebook!

THE DEATH OF OVERCLOCKING

That brings us to the most controversial aspect of Sandy Bridge: the death of overclocking as we know it. At least, that's probably what most enthusiasts will say when they hear the news that it will be extremely difficult to overclock the vast majority of Intel's new Sandy Bridge chips.

As you know, there are two ways to overclock a Core i3/5/7 chip: increasing the Turbo Boost multipliers (which can only be done on Extreme chips and K chips) or upping the base clock, or bclock. With LGA1156 and LGA1366 CPUs, the bclock relied on the clock signal being generated by a separate clock on the motherboard. With LGA1155, Intel has integrated a clock-signaling device into the chipset itself, and now when you goose the bclock, everything runs out of spec and gets ugly fast. With Sandy Bridge, you shouldn't expect a bclock overclock to net you more than 5 percent at best. That's a damned shame to those of us used to taking any old Core i3/5/7 and pushing the bclock from 133MHz up past 200MHz.

Conspiracy theories are already swirling that Intel did this because too many people were overclocking cheap chips instead of buying pricier ones. The company denies this. It says the main reason it moved the clock into the chipset was to save costs. While it may seem insignificant, integrating the clock into the chipset saves a board maker $5, which is a big deal. Intel officials say they didn't intend to put a clock block on our bclock, but it was an unfortunate casualty of engineering. Officials say it's quite possible that future iterations could see the return of bclock overclocking.

As a peace offering, Intel says that Sandy Bridge offers a couple of concessions to overclockers. The chip lineup includes two "K" CPUs: The 3.3GHz Core i5-2500K and the 3.4GHz Core i5-2600K. Both feature unlocked Turbo Boost multipliers and unlocked memory multipliers. Even better, the price premium for the K parts over non-K equivalents is minimal. The Core i7-2600 runs $294, while the Core i7-2600K will set you back $317. The price difference between the 2500K and the 2500 is just $11. Even for enthusiasts who aren't into overclocking, the K parts are a no-brainer. We ran ours near the 5GHz range on air with no issues. That's unheard of with previous quad-cores without the aid of exotic cooling.

For non-K parts, Intel is also throwing you a bone by letting you overclock up to four bins. However, this is limited to single-core overclocks, so it's not much of a bone.

So, do we buy Intel's explanation? Yes and no. Saving board makers $5 we get. But there are other aspects that make us think it ain't just about $5. Non-K chips also feature locked memory multipliers, so the fastest they'll run is DDR3/1333. That's certainly not related to money. Why couldn't Intel have unlocked all of the chips as it did with the K parts? The ultimate judge of how much backlash there will be is consumer response.

Will enthusiasts make a beeline for AMD? Our bet is no. Sandy Bridge's performance and the fact that each chip overclocks itself so damn well means that people will probably be OK with it.

The upshot, folks, is that Sandy Bridge offers a truly amazing amount of performance at previously unheard-of prices.

CHANGING OF THE GUARD

Out with the Old CPU, In with the New

Physically, the new Sandy Bridge LGA1155 processors look almost the same as the previous LGA1156 CPUs based on Clarkdale and Lynnfield. The key difference is under the heat spreader. Can you plug an LGA1155 chip into a LGA1156 board? Nope. Every time Intel does this, we wonder if the company is just trying to piss us off. And as always, Intel says no. It had to make the socket changes to meet the design needs of the new Sandy Bridge CPU. That won't help people who just bought a brand-new LGA1156 board and CPU and feel burned yet again by another socket switch from Intel. There's good news, though: The new socket doesn't require a new heatsink. The mounting holes are compatible with existing LGA1156 coolers.

On the left is the new LGA1156 and on the right is the old LGA1155.

Sandy Bridge Meets the Benchmarks

No matter how you slice it, Intel's new 2600K is a cold-blooded killer

People will look for a lot of reasons to hate Sandy Bridge: Overclocking is limited to the K parts, you have to buy a new board, and the graphics core is switched off once you install a GPU. But once you get to raw, ripping performance, it's hard not to gush over Sandy Bridge. Frankly, it's an astounding amount of performance for the money.

The top-end Core i7-2600K smashes every other quad-core Intel chip by healthy margins. This is aided by the new microarchitecture, the ring bus, and other magical stuff, we suppose, but we see no reason to buy any other CPU for the money. Even the once-powerful Core i7-975 Extreme Edition is flatly punched in the nose by the 2600K. While the 975 is long gone, you can extrapolate that the 2600K will outgun the Core i7-950, i7-930, and the poorly priced i7-960. Against non-Intel chips, it's no contest. AMD's hexa-core Phenom II X6 1090T, which was already getting beaten up by existing Hyper-Threaded Core i7 chips, also takes a serious thrashing from the Core i7-2600K.

Even the mighty Core i7-980X loses a few benchmarks to the Core i7-2600K chip. These are mostly in benchmarks that can't exploit the six-cores of the 980X, and where the Turbo Boost 2.0 gives the Sandy Bridge part a key advantage.

Certainly, overclocking the older Intel parts and the Phenom II can help, but the 2600K, we must add, also overclocks like a champ. So, haterz, set aside your hate. If performance is what you care about (and you don't want to shell out for a $1,000 hexa-core), Sandy Bridge, particularly the K versions, should be on your radar.

BENCHMARKS

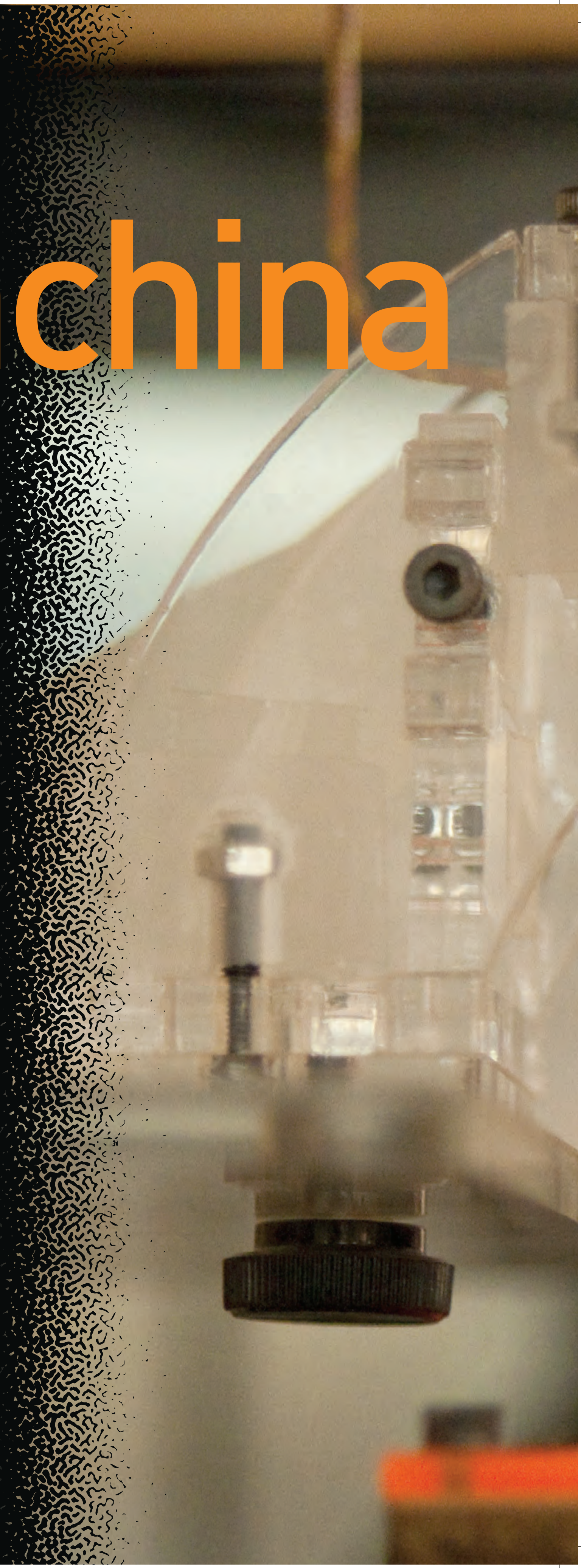
	3.4GHz Core i7-2600K	2.66GHz Core i5-750	2.8GHz Core i7-860	2.93GHz Core i7-870	3.33GHZ Core I7-975 Extreme Edition	3.33GHZ Core i7-980X	3.2GHz Phenom II X6 1090T
Premiere Pro CS3 (sec)	**453**	615	581	539	504	**453**	749
Sony Vegas Pro 9.0c (sec)	3,007	4,899	3,863	3,531	3,244	**2,675**	5,010
HandBrake DVD to iPhone (sec)	1,298	1,702	1,360	1,247	1,170	**941**	1,580
MainConcept 1.6 (sec)	2,134	3,092	2,735	2,486	2,308	**1,827**	2,816
Cinebench 10 64-bit	23,259	14,455	17,516	19,197	20,147	**27,479**	17,892
Cinebench 11.5 64-bit	6.87	3.83	5.15	5.54	5.99	**8.92**	5.67
POV Ray 3.7	4,979	2,810	3,883	4,497	4,236	**6,557**	4,656.5
Photoshop CS3 (sec)	**89**	118	123	100	91	**89**	130
Adobe Lightroom 2.6 (sec)	**394**	603	469	422	418	419	426
ProShow Producer 4 (sec)	**1,007**	1,425	1,382	1,290	1,208	1,092	1,669
Bibble 5.02 (sec)	121	186	142	122	120	**97.2**	145
PCMark Vantage 64-bit Overall	**11,250**	8,504	8,903	9,120	9,260	10,470	7,481
Fritz Chess Benchmark (KiloNodes/s)	**13,017**	8,407	10,997	11,995	12,738	12,733	11,219
Valve Map Compilation (sec)	**76**	110	116	106	100	99	132
Everest Ultimate MEM Copy (MB/s)	16,994	15,445	15,372	14,693	**17,712**	13,086	11,043
Everest Ultimate MEM Latency (ns)	**36**	54.3	49.5	52.5	59.8	61.3	51.6
SiSoft Sandra RAM Bandwidth (GB/s)	16	17	17	17	**23**	20	13
3DMark Vantage CPU	53,599	44,594	46,064	48,816	51,321	**62,893**	44,587
Valve Particle test (fps)	180	111	148	159	174	**259**	120
Resident Evil 5 / low-res (fps)	132	110.3	115.9	126.6	130.7	**134.1**	100.3
World in Conflict / low-res (fps)	306	256	253	253	317	**358**	162
Dirt 2 / low-res (fps)	**162**	155	94	153.3	157	155.7	121
Far Cry 2 / low-res (fps)	**165**	146.53	150.2	153.3	158.2	158.6	99
Price	$317	$196	$284	$294	$999	$999	$235

Best scores are bolded. We used 64-bit Windows 7 Professional, 4GB of RAM DDR3/1333 (for the dual-core chips) or 6GB of DDR3/1333 (for the tri-channel chips), a Western Digital Raptor 150 10,000rpm hard drive, a GeForce GTX 285, and the same graphics driver for all of our test configurations.

Ex Machina

Is the MakerBot a hacker-friendly version of My Little Cupcake or a harbinger of a major sea change?

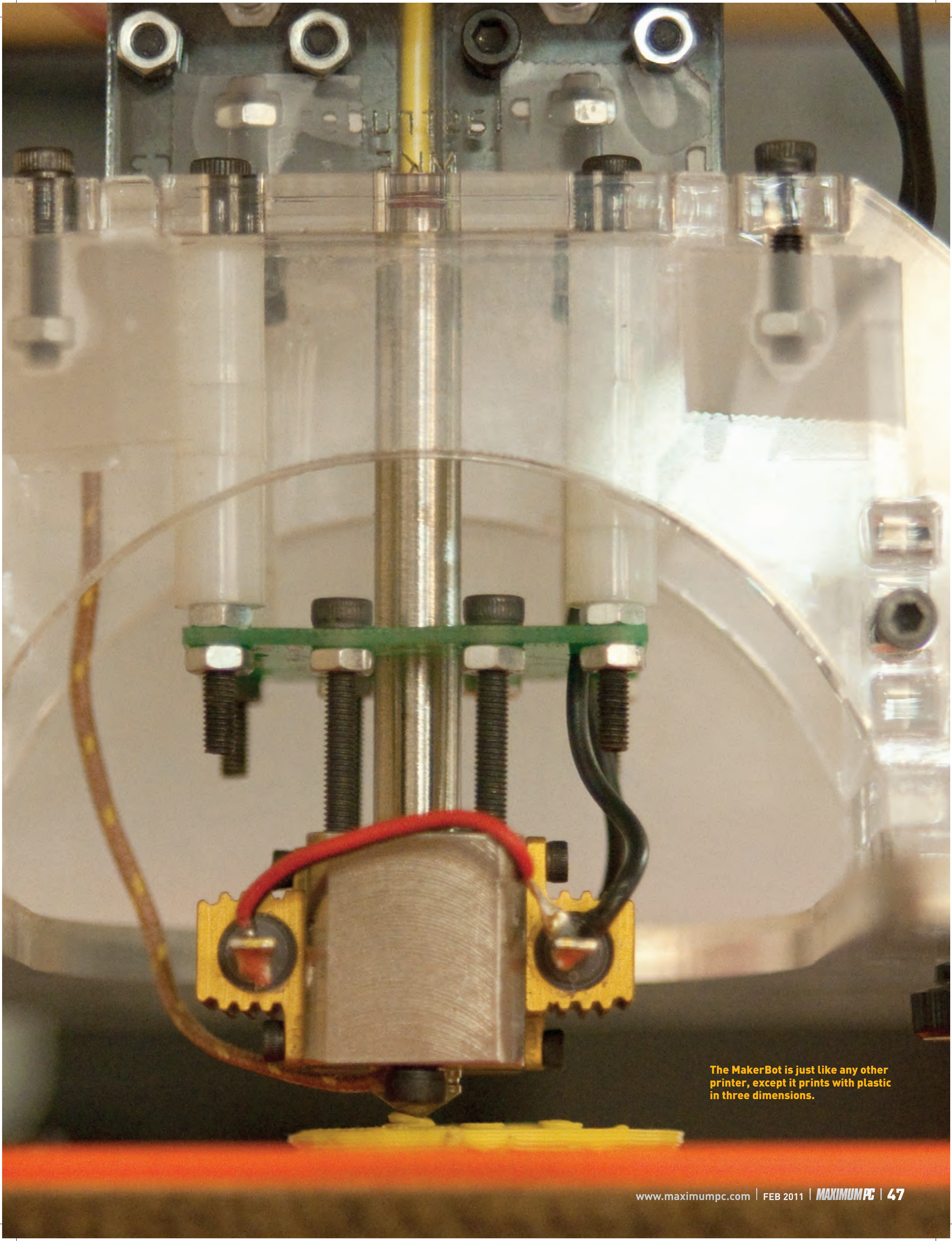
BY QUINN NORTON



We are in a warehouse near downtown Brooklyn dubbed the Botcave. We're talking with MakerBot Industry founders Bre Pettis, Zach "Hoeken" Smith, and Adam Mayer, and we're contemplating a future where we can all instantly download, distribute, and manufacturer anything, anytime, anywhere. The implications are mind-boggling.

The road to utopia begins with a much cruder and smaller realization of this vision, however. The MakerBot guys hook up our laptop to the Cupcake, a $900 build-it-yourself 3D printer made of etched wood that is painted and lined with blue LEDs. It glows like something from a steampunk novel. We load up a design and start a print job. The gears and motors on this homegrown 3D fabricator sing. The extruder lays down string after string of hot, red plastic. Ten minutes later, Bre Pettis snaps a small toy violin off the building platform. "There," he says, "the world's smallest open-source violin."

Like the MakerBot machine itself, the Botcave is recursive. It is quite literally a factory that makes and sells desktop factories, with the intent of evolving modern-day hacking to far more ambitious levels. In the following pages, we'll examine the dreams, the technology, and the future of this forward-thinking invention.



The MakerBot is just like any other printer, except it prints with plastic in three dimensions.

HOW MAKERBOT BEGAN

"Bre and I actually started Thingiverse before we started MakerBot," Hoeken explains. The two noticed that whenever they tried to explain their vision of the future—where objects exist as software, and you can download whatever you need and print it out—people responded enthusiastically. "They'd say, 'Oh that's great, I'd love to do that, where do I go?'," says Hoeken. But he didn't have an answer. "So, we created Thingiverse (www.thingiverse.com) as a place where we could share our stuff."

At the time, the 26-year-old Hoeken, whose claim to fame also includes making a pair of keyboard pants for a 2009 New York fashion show, was involved with RepRap (www.reprap.org), an already-established 3D-printer project. Hoeken wanted to build a simpler version of the RepRap machine that anyone could use. With this in mind, he, Pettis, and cofounder Adam Mayer used the resources, including a laser cutter, at a hacker collective named NYC Resistor to build the first MakerBot prototype. Eventually the trio quit their day jobs to work full-time on this new 3D printer. "Zach said, 'Quit your job and build robots with me'," says Mayer. "I don't think you're allowed to say no to that."

MAKING THE MAKERBOT

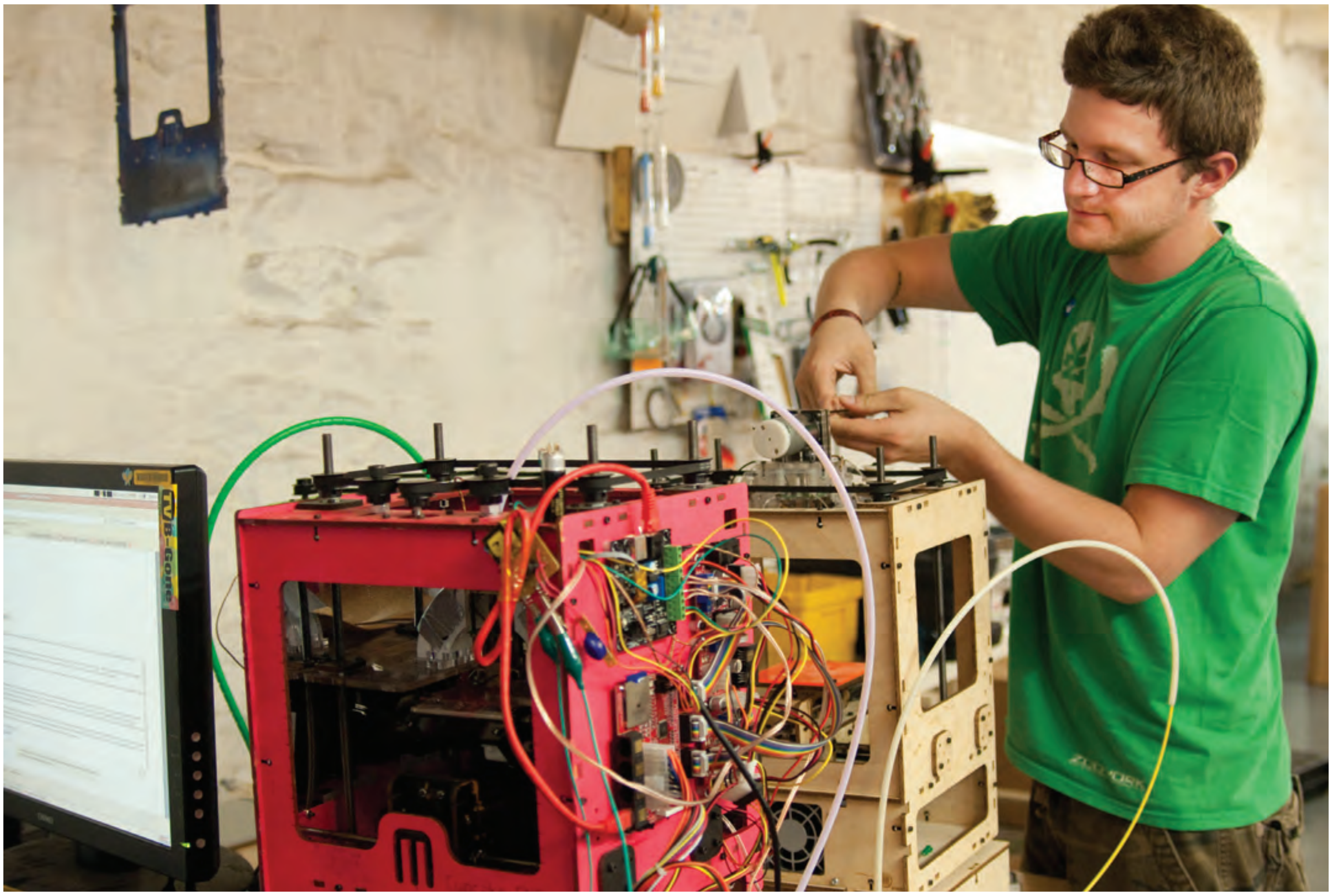
Let's be clear: The MakerBot isn't Ikea-easy to assemble, but a *Maximum PC* reader should enjoy the 8–12 hour build. This is definitely an RTFM project. Both the Cupcake and Thing-O-Matic versions of the machine (the Cupcake can print things about the size of a cupcake; the newer Thing-O-Matic prints slightly larger objects, about the size of a kitten) use a standard ATX power supply and a series of boards connected by Ethernet and ribbon cable.

That's where the similarity to PC building ends. Thankfully, detailed step-by-step assembly instructions guide you through the process of putting together pulley systems, belts, and rods, as well as screwing together the wood and plastic panels and hooking up the stepper motors and the electronics.

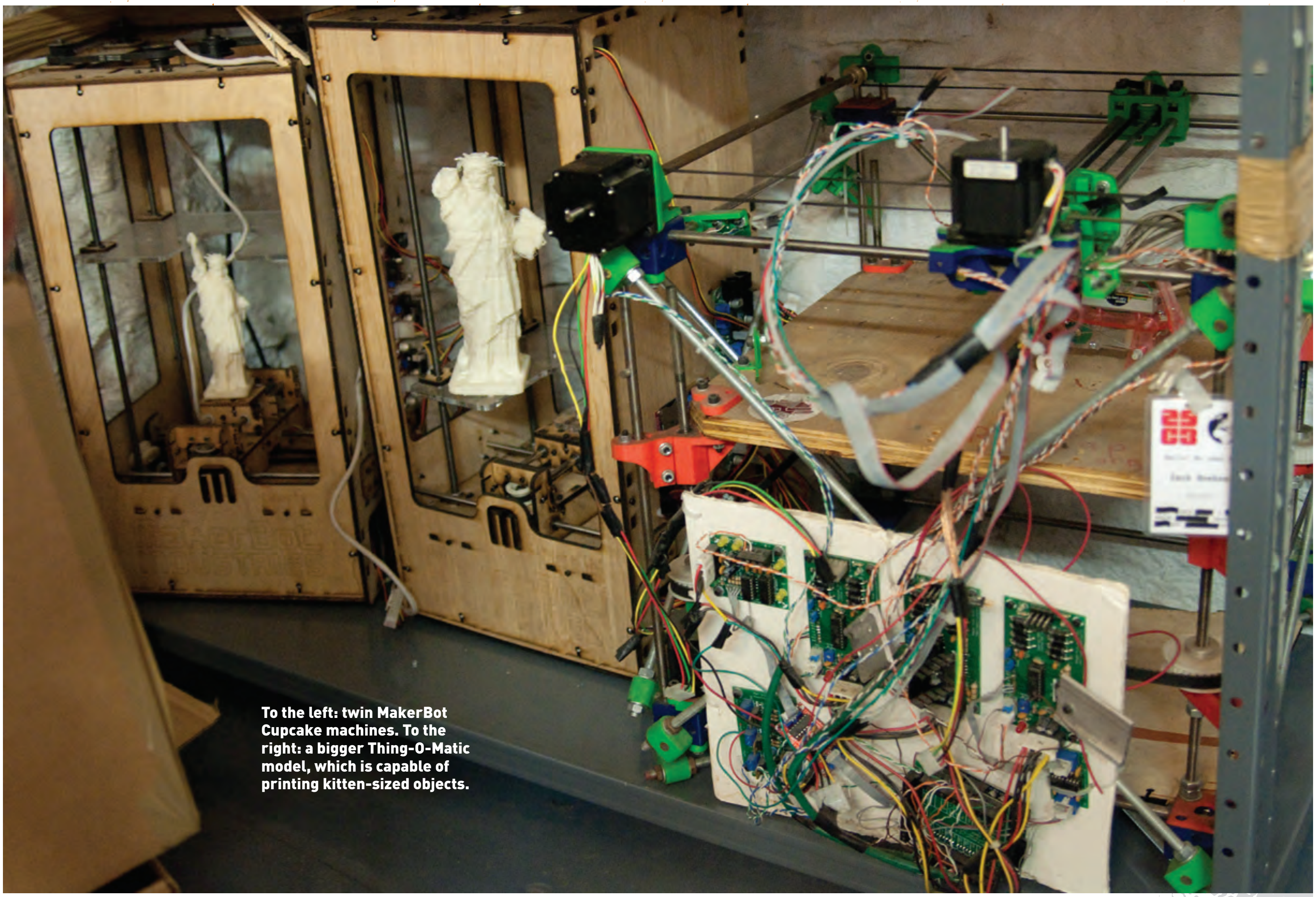
Once completed, the MakerBot is about the size of a microwave standing on its end. It prints recyclable ABS plastic-acrylonitrile butadiene styrene—the same material Legos are made from—and biodegradable corn-based PLA (polylactic acid). The beauty of the MakerBot is that, like its hereditary predecessor the RepRap, all the software and hardware the device uses are open source, so theoretically you don't even need to buy a kit from MakerBot to build one. But it's definitely cheaper and a lot easier to put together this way.

USING THE MAKERBOT

Fabricating objects with the MakerBot



Thus far, the MakerBot factory—dubbed the Botcave—has sold and shipped 2,600 MakerBot machines all over the world.



To the left: twin MakerBot Cupcake machines. To the right: a bigger Thing-O-Matic model, which is capable of printing kitten-sized objects.

entails a few different steps. You start manufacturing an object one of two ways: You design it yourself using a 3D modeling program, or you download a pre-existing object from the Thingiverse. We love *Maximum PC* so much that we designed our very own object and loaded it into the Thingiverse for others to enjoy. Here's how the process worked.

We started with Google's free SketchUp 3D software package (sketchup.google.com), and designed a circular object with an opening in the middle. It could be a cable organizer, or for our more formal readers, a large and sturdy napkin ring.

SketchUp is easy enough to use that we were quickly able to visualize and build our object in three dimensions. Unfortunately, it does not save projects in the proper data format for Thingiverse. For this conversion, we turned to Blender, a powerful General Public License 3D software suite. (You could also use Blender to build your object, but it's much more complicated than SketchUp.) We converted SketchUp's .dae file format into a .stl file and saved it to www.thingiverse.com as "Maximum PC Round Thingy."

This .stl file needed to be translated into data the MakerBot can use to print a 3D object. We used a series of Python scripts called Skeinforge to chop the solid model into "slices" corresponding to the thickness of the layers of plastic that are extruded, and calculate the infill necessary to connect everything. Skeinforge also allowed us to set variables such as density and solidity, as well as the speed and position of the build.

Not surprisingly, printing an object requires some user tuning, and often takes a few tries to generate the exact piece you want. And, just like PC parts and technology, component-specific variance, inconsistent voltage, and heat/humidity can all affect the outcome of your projects.

STARTS WITH A WHISTLE

Ironically, the future the MakerBotters dreamed of, where objects are ideas to be imagined, shared at the speed of light, and changed and shared again, actually started with a referee's whistle.

"That was the teleportation moment," says Mayer. The whistle was created by Eberhard Rensch in Offenburg, Germany. In an effort to explore and extend the limits of his MakerBot Cupcake, Rensch redesigned the machine and upgraded the extruder

by printing new parts and modifying the device's firmware.

"The whistle originated from the [desire] to print 'unprintable objects' with the MakerBot," says Rensch. "The MakerBot doesn't print with a second support material. Thus, it's not possible to print large overhangs or objects with captive parts." With this in mind, he designed a whistle—an object with both a captive part (the ball, also known as a pea), and an unsupported overhang (the mouthpiece). To get around having to print a sphere for the pea inside the whistle, he made an icosahedron, a symmetrical 20-sided shape similar to a 20-sided D&D die.

Within four hours of Rensch uploading his whistle, other MakerBot owners around the world had printed 10 copies of it. "There's no way you can ship a whistle that fast, MakerBot founder Adam Mayer exclaims."There's no way to move a physical object that quickly, and there it was, popping up all over."

MEANWHILE, BACK IN BROOKLYN...

Once we get our "skein" output from Skeinforge ready, we dump it into ReplicatorG, an open-source 3D-printing program that allows your PC to control the MakerBot. ReplicatorG runs G-Code, which is the de facto standard for CNC (computer numerical controlled) machines and is essentially a series of coordinated instructions specifying location, speed, and on/off commands for the device's three stepper motors and plastruder. The application monitors barrel temperature and lets you tweak the size and modify the flips and rotations the printer makes as it constructs your object.

Once we've heated the barrel and platform, fed the plastic into the top of the plastruder, and set the head against the build platform, everything is ready to print. The motors are connected to two X- and Y-axis sliders that continually reposition the build platform, and a Z-axis that controls the vertical position of the plastruder. The MakerBot machine begins an elaborate dance, with the platform sliding back and forth while the plastruder moves along the Z-axis.

Essentially a print head for your MakerBot, the plastruder is the most complex bit of machinery. The MakerBot wiki describes it best—it's like a robotic hot-glue gun whose main purpose is to heat up your plastic, and then extrude it in a fine stream. Two key components make up the plastruder. First, a filament drive uses the gearing's teeth to grip the plastic and push it through a Teflon tube into the heater. The second element, the hot end, consists of a heated stainless barrel that the Teflon tube runs through, which both heats and directs the plastic through a narrow nozzle.

A thermocouple attached to this stainless tube provides temperature readings back to the firmware, and ultimately, ReplicatorG. All of this is attached to a stepper motor, which builds along the Z-axis by raising and lowering the plastuder assembly.

The machine isn't quiet, but the stepper motors have a smooth, almost synth-like sound that slides into a kind of robotic power chord. Initially, it's surprising how musical these machines are when in action; some patterns emit such a solid funk-eletronica groove that a library of MakerBot music now resides on the Thingiverse, with no plastic required to hear the samples.

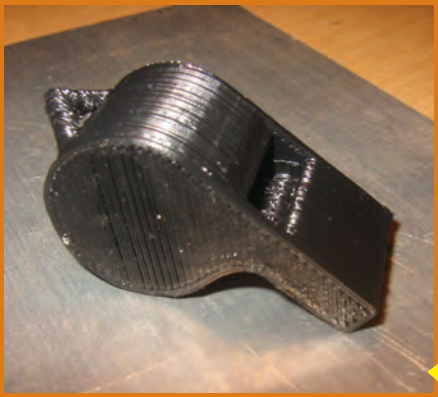
WHAT CAN YOU MAKE?

Many of the founder's favorite models are the simple ones, objects someone made in order to solve everyday problems. One of the earliest uploads to Thingiverse was a bath plug. Thingiverse user Batist designed and posted it after realizing he didn't have one.

Simple things like doorknobs, hooks, and bath plugs demonstrate how quickly and easily a 3D printer that's integrated with a file-sharing site can integrate into our lives, but the projects of Cathal Garvey of Ireland

EXTRUDE THIS!

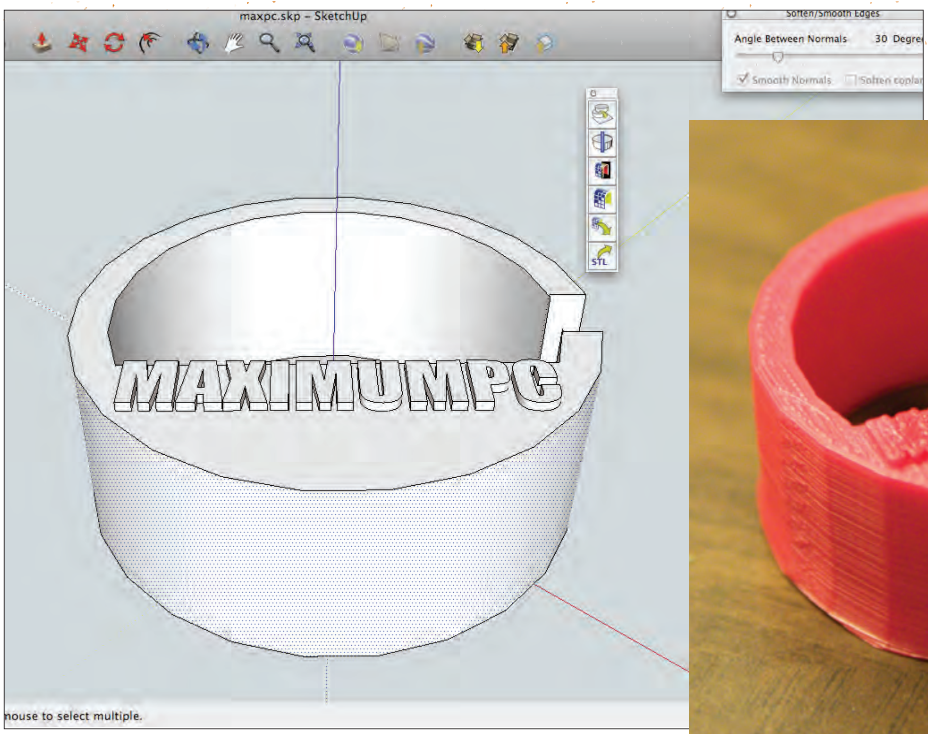
The Three Most Popular MakerBot Products



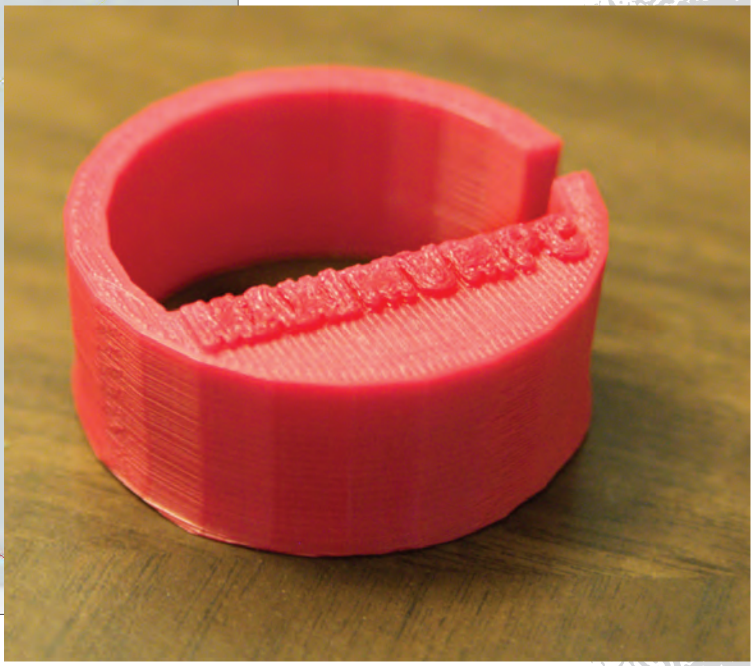
WHISTLE The beauty of this project is that it prints the pea right inside the whistle; you use a screwdriver or tweezers to break it loose.

GOTHIC CATHEDRAL PLAY SET Designed by Michael "Skimbal" Curry, who calls this build the "Mount Everest of MakerBot prints," mostly because of the large number of overhangs and arches. The full model is made of 20 different parts.

MICRO LATHE For geneticist Cathal Garvey, printing a micro lathe was one of the first steps in replicating a host of biological lab equipment.



We designed this object in Google's free SketchUp application, then imported it into Thingiverse.com.



demonstrate a much more ambitious potential. Garvey is a geneticist who is working to replicate as much biotech lab equipment as he can with a Dremel and a MakerBot.

"The [biotech lab] equipment is incredibly expensive. It costs ten or a thousand times what you'd expect," says Garvey. Thus far, his open-source models include a gel electrophoresis for analyzing DNA, a Dremel-driven micro lathe, and the Dremelfuge, a centrifuge that fits standard tubes. The Dremelfuge took a lot of tries to get right. "In the end, I got one that printed correctly, fit the Dremel snugly, fit the tubes snugly, and I spun the tubes," he explains. But unfortunately, "at any speed above the second setting, the tubes would go flying out."

The Thingiverse community came to the rescue, helping Garvey improve upon the design to the point that he was able to make a Dremelfuge that could operate at top speed, saving himself thousands of dollars in the process. "What I like about Thingiverse is that it's not trying to reclaim an open culture," he tells us. "It's founding an open culture."

Garvey can see the small bits of plastic that fill every corner of our lives going the way of long-distance communication and music—no longer hard or scarce enough to support their traditional business models. "They are going to have to find something else scarce to sell," he says.

REPLICATION IS COMPLETE

Back in Brooklyn, MakerBot Support Manager Isaac Dietz notices something and summons everyone to his monitor. A man named Christian Arnø in Norway has uploaded a 3D blueprint for a complete MakerBot clone to Thingiverse, uploading the design in roughly 160 pieces. Anything that isn't electronics or metal is MakerBotted ABS plastic. Unlike its RepRap predecessor, the MakerBot wasn't designed to be self-replicating. But there it is anyway, a 3D printer printed on a 3D printer. People all over the Botcave are cheering.

Dietz starts rounding up things to send Arnø. There's no contest to win, but everyone feels the same: This deserves a prize. He quickly grabs a book and a t-shirt before someone brightly suggests that what Arnø probably needs the most at this point is more plastic. A half pound of bright red plastic goes in the box.

The energy and attitude at the Botcave are infectious, but they also reinforce the notion that these are frontier days for MakerBot and its dreams of ubiquitous do-it-yourself 3D printing and fabrication. To date, the company has sold 2,600 MakerBots. That's not bad, but it's not quite world domination. But what if these guys are right? The notion that Bre Pettis, Zach Smith, and Adam Mayer might be harbingers of a new personal industrial revolution conjures up sepia-toned images of Thomas Edison's Menlo Park lab in the late 19th century. Or Jobs and Wozniak tinkering away in a Northern California garage in 1976.

That's a long way off. For now, MakerBot will move forward in small steps. As an example, the new Thing-O-Matic model prints larger items. And most recently, MakerBot added an optional automated build platform, making it the first 3D printer capable of continuously printing the same model over and over again, like a traditional factory.

What about after that? The founders are working on a 3D scanner and associated software that would allow you to seamlessly copy an existing item. And, in a tacit acknowledgement of the potential evil of plastic, the MakerBot community is still trying to find a way to throw printed objects into a hopper and quickly pull reusable plastic back out.

It's hard to say if geneticist Cathal Garvey is right, that home fabrication will do away with the market for the small, hard, plastic bits of modern life. But it's easy to imagine an explosion in creativity tied to sharing physical objects, whether we're printing PC parts and modifications, creating home bio labs for teens, or just chaining together collaborative Rube Goldberg machines. Ultimately, the easier it is to realize our dreams, the more innovation we'll see in art studios, labs, and garages.

WHITE PAPER

Graphene

A recently isolated material could advance displays, batteries, solar cells, and computers beyond silicon –ZACK STERN

The tip of your pencil contains the future of computing, touch-screen displays, solar cells, gas detection, and the strongest, lightest physical materials ever. Each scribble leaves layers of this recently isolated super-substance.

It's called graphene, and it's a one-atom-thick hexagonal-grid pattern of carbon atoms. It looks a little bit like chicken-wire—or the Settlers of Catan board—only 100 million times smaller.

In its sheet form, it's the first two-dimensional, crystalline substance that's ever been isolated. It can be rolled into tubes—carbon nanotubes—that behave as a single-dimension material, and can even be made into a zero-dimensional ball. These multidimensional properties allow for new research and experiments down to a quantum-physics level.

We'll explain the coming graphene boom, how the material is harvested, and why this space-age material could change everything from airplanes to mobile phones.

HARVESTING EXPLOSION

The 2010 Noble Prize in Physics was awarded to Andre Geim and Konstantin Novoselov for their research isolating graphene. Prior to their discovery and 2004 paper, scientists thought graphene couldn't be stable in a single, one-atom sheet.

In what Geim calls a "Friday night experiment"—a test on a whim at the end of the day—the scientists affixed cohesive tape to a chunk of carbon. Peeling it back, they tore off clusters of more than 100 layers of graphene. But by sticking the tape back to itself, they cleaved off smaller and smaller layers of graphene.

In the end, they discovered single layers of graphene flakes by viewing the substance on top of silicon oxide. A slightly pink halo revealed the location around the virtually clear substance; about 98 percent of light passed through the layer. In subsequent experiments, other scientists reproduced their technique, setting off a boom in graphene experimentation.

Graphene can be produced in many ways in addition to this low-tech method. In 2009, scientists devised a means of growing graphene suited to larger commercial applications. Researchers heat a silicon carbide wafer to 1,300 C, at which point the silicon layer bakes off, leaving the carbon atoms, which realign into graphene. This method can be used to pattern or cut into shapes for microelectronics.

POWERFUL PROPERTIES

Graphene's many unique properties lead to a wide range of potential applications. Two hundred times stronger than steel, it's possibly the lightest, strongest material ever discovered, suitable for airplane parts and other high-pressure, low-weight applications. It conducts electricity with an extremely low resistance—faster than silicon—making it suitable for many electronics applications.

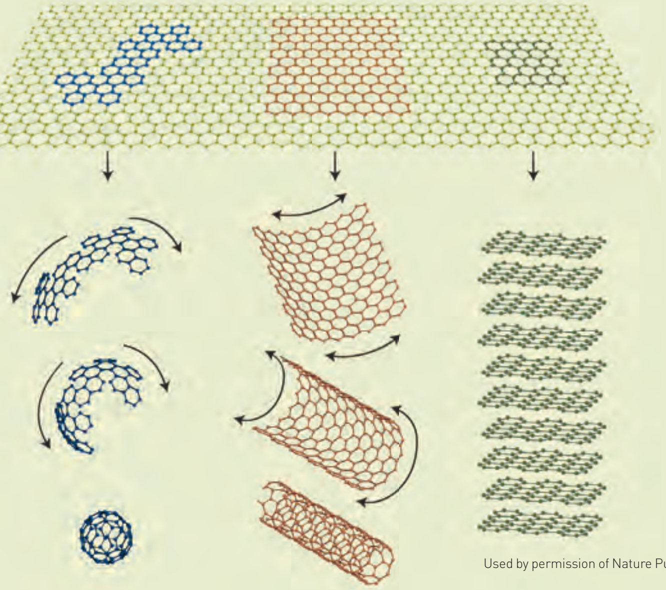
These traits, combined with graphene's transparency, could also make the material a key component in building more functional lightweight OLED, LCD, and touch-screen panels. And with its large surface-to-volume ratio, graphene in powder form could even improve batteries.

Graphenes's electrical properties are leading to branching ideas about the future of computing. "You can try to do everything in a similar way but find a material that can maybe do it better [than silicon]," Dr. Roland Kawakami, an associate professor of physics and astronomy at the University of California, Riverside explains. "Maybe we can make a better transistor."

Following this logic, graphene could be built into tiny transistors that can move single electrons around with electromagnetic forces. An electron will come to an obstacle in its path—

HOW IT WORKS

Graphene's Versatility



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Graphene is a 2D building material that, when isolated, can be wrapped into buckyballs, rolled into nanotubes, or stacked into graphite.

like a wedge—and have to move around it in one of two directions. This choice reproduces the binary basis for the rest of the computer. Theoretically, these transistors would be smaller, consume less power, and yield much higher speeds than current silicon. Heck, we might see 100GHz mobile phones based on the technology in coming decades.

The counter alternative to transistor replacement, according to Dr. Kawakami, is to "try to do computing in a different way. So… maybe you can have additional benefit since you're doing something fundamentally different," Kawakami says. His research relates to spin computing, and rethinking processing paradigms down to an atomic level.

Here's the logic: Electrons don't just have an atomic charge, they also have spin, behaving like tiny magnets with a north and south pole. Spin computers can take advantage of this polarity to process and store data; it's similar to the magnetic alignment of current hard disks. This spin can be oriented in many directions, easily accommodating the current binary concept as "up" or "down," while allowing for further expansion.

The problem is that when researchers try to inject spin into semiconductors, they have to cool them to cryogenic levels, such as 100 Kelvin. Even then, it works poorly. Graphene can maintain this spin much longer and do so at room temperatures. Kawakami has researched ways of extending the spin further by layering graphene with a thin insulator. Spin is injected through the insulator, and the extra material helps prevent it from leaking out immediately.

The spin can now last significantly longer than a nanosecond, with theoretical estimates of it lasting between a millisecond and microsecond. While these times don't sound long, consider a processor that runs at 1GHz—a graphene-based spin computer could retain information for up to a million cycles.

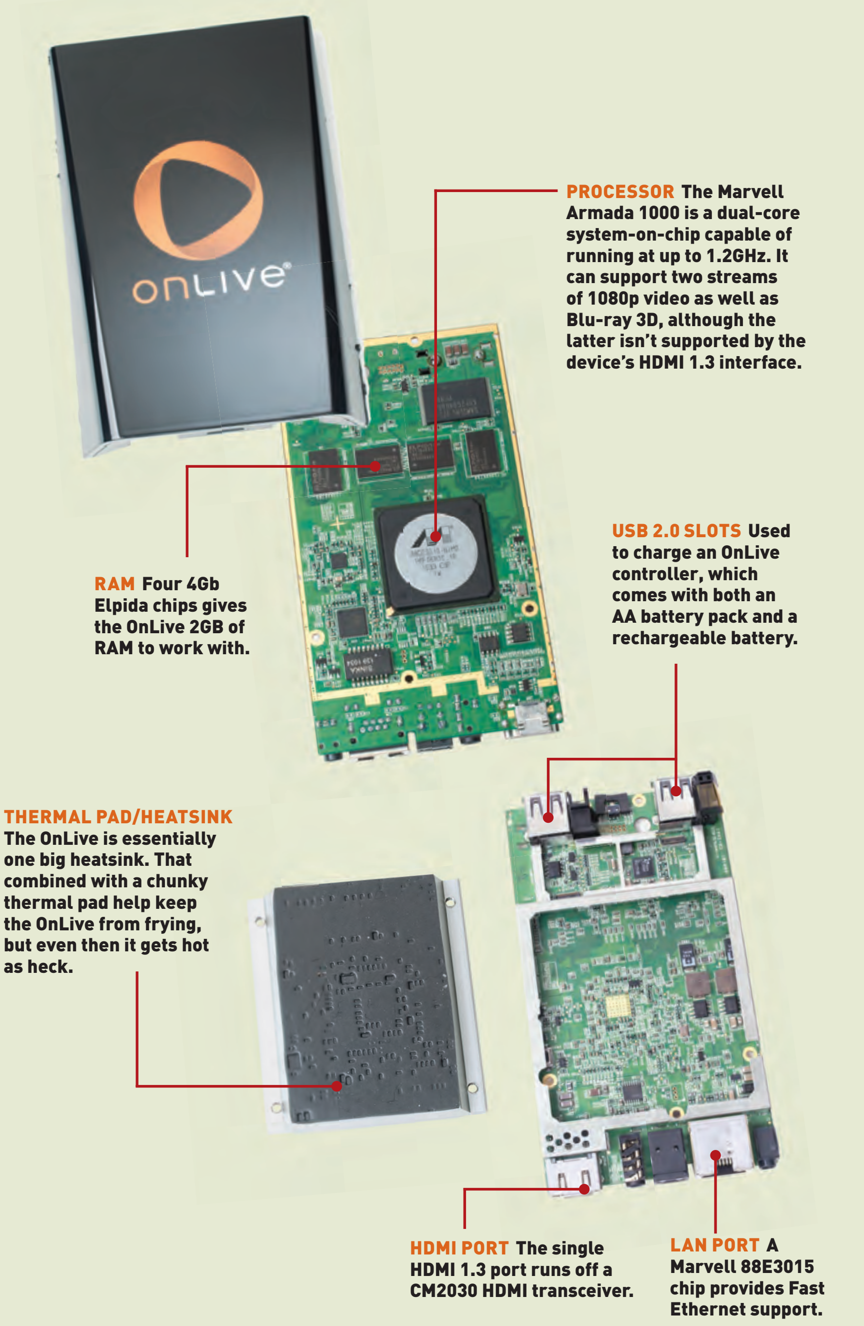
COMMERCIAL GRAPHENE?

With so many uses and with the cost per yield continuously dropping, you can expect to see the first commercial uses of graphene in the next two to three years. More ambitious usage will, of course, take decades to develop. This said, some companies, such as Samsung, are already testing 30-inch graphene-based display prototypes.

Kawakami says, "There are certain things we can already do based on this last [research]." So, how long will it take until graphene computers make it to the market? "At the very optimistic end," Kawakami responded, "[it will take] at least 15 years."

OnLive Microconsole

OnLive's new microconsole has finally made cloud-based gaming viable. Though massive OnLive servers must be tapped to effectively "stream" games, we wondered what powers this tiny 5x4x1.25-inch console. Getting it apart wasn't easy—it became clear after the judicious use of prying tools and a heat gun that OnLive doesn't want the device taken apart. Undeterred, we pried the little guy open for a look inside.



SUBMIT YOUR IDEA Ever wonder what the inside of a power supply looks like? Don't take a chance on destroying your own rig; instead, let us do the dirty work. Tell us what we should crack open for a future autopsy by writing to comments@maximumpc.com.

HOW TO

Step-by-Step Guides to Improving Your PC

THIS MONTH

58 CLEAR UP HARD DISK SPACE WITHOUT DELETING GAMES OR MEDIA

60 TAKE CONTROL OF THE WINDOWS CONTEXT MENU

KINECT: EVERY HACKER'S DREAM

ALEX CASTLE
ONLINE MANAGING EDITOR

I'm a big fan of new and exciting user interfaces. It's what compelled me to spend a couple of weeks building my own multitouch surface computer (check http://bit.ly/aEpDiZ for the full how-to) and why I like using the iPad so much, much to Senior Editor Gordon Mah Ung's chagrin.

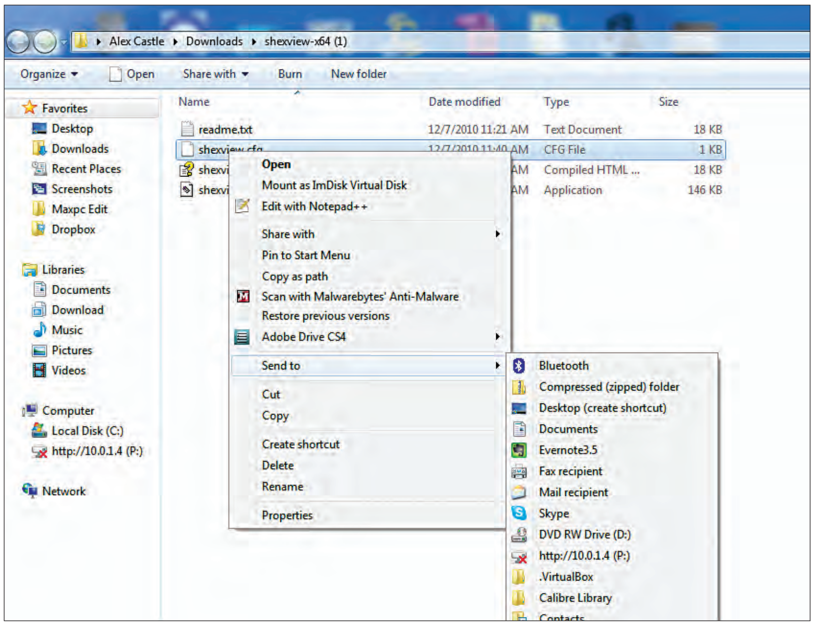
That's why, for me, Microsoft's Kinect is one of the most exciting pieces of technology to come out in a long time. Not because I'm dying for another motion-controlled gaming platform (although Dance Central is embarrassingly fun) but because of its potential for hacking.

Open-source drivers have already been developed and released for the Kinect, and some amazing videos of early Kinect-on-PC software have been released so far (http://bit.ly/bZDgvQ, http://bit.ly/cUsrQW, http://bit.ly/cU7R4t).

It's actually possible (as of press time) to get your Kinect working on your PC with free software by CodeLabs (at http://codelaboratories.com/nui), but there's just not enough software available to warrant a full how-to right now. I guarantee that will change, so keep your eyes open for more from us about Kinect.

SUBMIT YOUR IDEA Have a great idea for a How To project? Tell us about it by writing to comments@maximumpc.com.

WINDOWS TIP OF THE MONTH



Supersize Send To

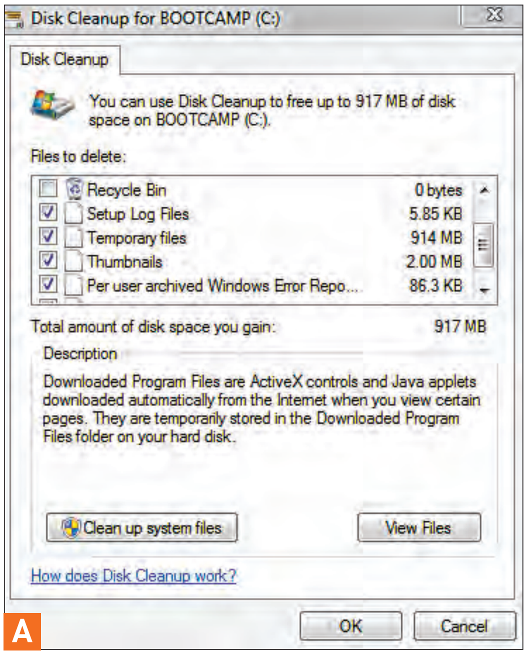
A handy context menu option for quickly moving files around is Send To, which lets you shoot a document to one of several predetermined locations on your computer. If you want even more options from Send To, hold down the Shift key as you right-click the file. You'll notice that the list of possible destinations is much longer.

Clear up Hard Drive Space without Giving up Data

The Holiday season is just recently past, and a lot of good boys and girls will have gotten a PC game, application, or iTunes gift card in their stockings this year. However, in order to enjoy your new software or media, you have to have enough hard drive wiggle room to use it. To get the job done, you could set out to delete a score of chunky media files and sizeable programs that you only use on occasion. You could also opt to purchase and install a larger hard drive to solve the problem. Either of these plans will do the trick, but before you start working over your files with a machete or plug in any new hardware, we'd suggest taking a few minutes to read our handy three-step guide on how to free up some hard drive space on your desktop or laptop without being forced to delete any important files. Let's get to work! –SEAMUS BELLAMY

1 DISC CLEANUP

No matter whether you're a casual user or an enthusiast, your daily computing takes a toll on your hard drive. With all of the temporary Internet files piling up on your system, downloaded installation files, optional Windows components that you'll never use, and Windows temporary files, it's a wonder that any of us have any drive space left at all. To start whittling away at some of the unwanted bloat currently squatting on your hard disk platter, you needn't look any farther than Windows 7's Disk Cleanup tool. For a built-in feature, Disk Cleanup packs a pretty potent punch, and can start you off on the right foot to freeing up space. The fastest way to get cracking with Disk Cleanup is to simply type the program's name into the Start Menu search field. Disk Cleanup offers you a number of options regarding which files to keep or delete from your hard drive (image A). Just select the file types you want to do away with and click the OK button. Depending on how often you run Disk Cleanup, this operation can regain a lot of disk space for you, or a marginal amount. In either instance, it's well worth the effort.



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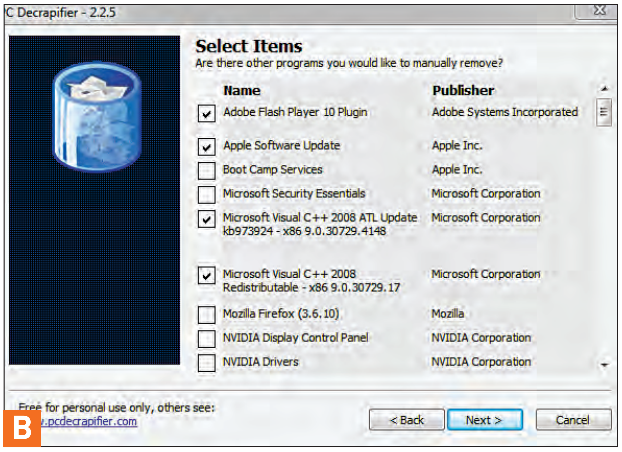


B

2 DECRAPIFY

We always recommend building your own system, but we know that some people can't resist the temptation to buy pre-built. If that's the case for you, you've likely got some bloatware kicking around your system. Bloatware—or crapware, as it's sometimes known—is the unwanted, mostly useless software that comes pre-loaded on your machine as a punishment for something you did in a past life. To get rid of bloatware, you could uninstall each unwanted application one at a time via the Windows Control Panel, or you can download the utterly awesome PC Decrapifier (free for personal use, $20 for commercial users, www.pcdecrapifier.com) and do away with it all in one go.

The software is a cinch to install, and provides options to run it as if it were installed on a new computer—with more robust bloatware-cleaning options—or on a computer that you've already set up and have been using for a while. Users are given the option of setting a system restore point to save your bacon should you run into any unforeseen errors while cleaning up your hard drive. After scanning your drive for suspiciously useless software, PC Decrapifier gives you the option to remove bloatware and other unwanted applications from your computer with no more effort than it takes to click your mouse a few times (image B).

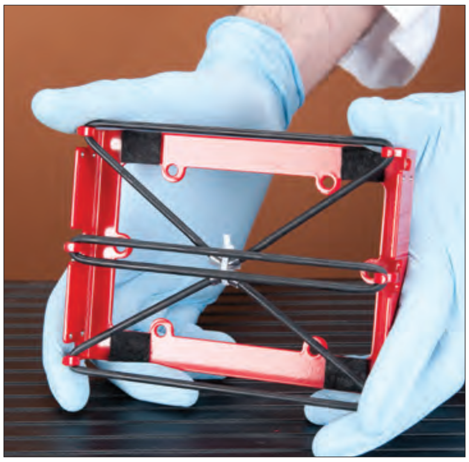
3 CCLEAN UP YOUR ACT

While some folks might find they're able to free up enough drive space to run their holiday spoils by cranking on Windows 7's built-in Disk Cleanup utility or PC Decrapifier, others whose hard drives are truly packed to the gills may need something a bit hardier to get the job done. For such troubled souls, we suggest CCleaner (www.piriform.com).

When it comes to cleaning and optimizing your PC, there are few more robust tools available than CCleaner, and especially not for the low, low price of free.

Warning: During the software's installation process, you'll be asked whether or not you'd like to install Google Chrome and make it your default browser (image C). While we can appreciate the irony of being offered additional software while installing an application designed to remove bloat from an already overcrowded hard drive,

Big and gaudy, just the way we like our CPU coolers.



Though it looks like a futuristic torture device, the NoiseMagic No-Vibes III is really more like a hammock for your drive.

this behemoth of a cooler; and replacing one such mission-critical screw upon finding that it had snapped off within one of the mounting brackets. Thank [deity of your choice here] for spare parts.

Why go aftermarket, you ask? By slapping an ungodly large dual-fan cooler over the Intel Core i7-930 CPU, I believed I could achieve stronger cooling without having to crank the device's fans to ear-splitting revolutions.

I slapped the cooler onto the CPU, then screwed the whole assemblage—motherboard and all—onto the chassis using the case's built-in mounts. At this point, it appeared that I had reached the halfway point in our little adventure. The sweet silence of raw gaming power was in my grasp!

DRIVE SILENCING

I opted to try out some NoiseMagic No-Vibes III hard drive silencers for the rig, in the hopes that every little bit of sound-dampening available would allow the system to achieve top-notch results. Hard drive vibration, after all, can have an impact on the acoustic profile of a PC. However, I only ended up using the kit on one of the two hard drives—the 2TB Seagate Barracuda XT storage drive.

Why's that? The other drive, a 600GB WD VelociRaptor, is a 2.5-inch device mounted on a 3.5-inch cooling bracket affectionately known as an IcePak. And the rubber-based drive tray that I used to stash it in my Silverstone PS05's drive bay was more than adequate for preventing extraneous noise. Turning the drive on added nothing to the case's overall noise.

Also, using one of the NoiseMagic No-Vibes III drive silencers turned my 3.5-inch

DIY SOUNDPROOFING

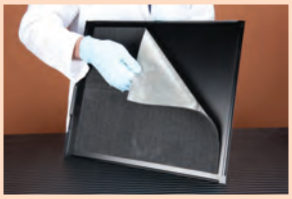
How to Install Acoustic Foam

Sticking a hunk of acoustic foam in one's case is far easier than it might appear at first glance. Cut the foam to the desired length, remove the adhesive, and let 'er rip.

Now, where do you stick the material? Anywhere you'd like—provided you aren't covering any active ventilation areas, like the cut-out holes used by a spinning fan. I stuck soundproofing foam to the top, bottom, sides, and front of my chassis. The more foam you use—or the thicker the material—the more you'll be able to keep errant noise from escaping.

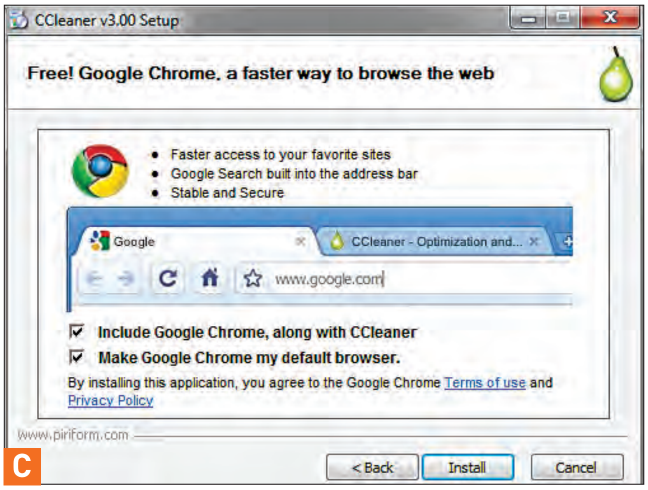
One caveat: Make sure you measure how much wiggle room you have to work with. Slap a full 2 inches of foam on the side panel of your case, for example, and you might not be able to actually get the panel on.

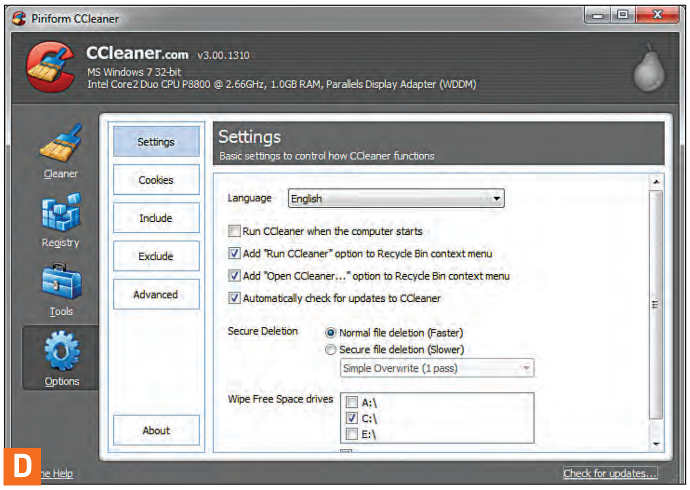
Soundproofing foam, meet case door. Case door, meet soundproofing foam.



Simply peel back the adhesive backing on your foam to begin—careful, it's sticky!

Gently apply foam to the case, ensuring that you don't (accidentally) cover any ventilation holes or mounting bits.





you're going to want to take the time to deselect the option to install Chrome before proceeding with your installation.

Once downloaded and installed on your system, CCleaner will make short work of just about anything you can throw at it (image D). Available as either a 32- or 64-bit application, CCleaner will not only clean the temporary files, history, cookies, download history, and form history from most modern browsers, it will also rip right into Windows itself, purging recent document history as well as the OS's Log and Temporary files. Once it's finished with the usual suspects, you can also choose to set CCleaner loose on your Registry to remove unwanted ActiveX controls, ClassIDs, old file extensions, questionable shared DLLs, and broken shortcuts. If that's not enough for you, the software can also remove temporary and recent files from a truckload of popular applications like Microsoft Office, Google Toolbar, and Adobe Acrobat. Best of all, thanks to another free download called CCleaner Enhancer (http://bit.ly/hngyWu), the program's functionality has been extended to cover an even wider range of software applications, and also allows you to set up a maintenance schedule so CCleaner will clean and maintain your hard drive from here on through to eternity.

Now that you're armed with the tools you'll need to get the job done right, there's no excuse for you not to install your new software and get back to ignoring your family and friends.

Take Control of Your Context Menu with ShellMenuView

The Windows context menu—the set of options that pops up when you right-click a file or folder—is one of the quickest ways to execute simple commands. That's why it's unfortunate that Windows doesn't give users any real control over the contents of these context menus. Programs sometimes install rogue options (or sets of options) in the menu, and there's no easy way to get them out, short of uninstalling the program.

Enter ShellMenuView, a free program from NirSoft (makers of a ton of great, techy system utilities) that allows you to view and edit the context menu options for all the different file types on your PC. Here's how to use it. –ALEX CASTLE

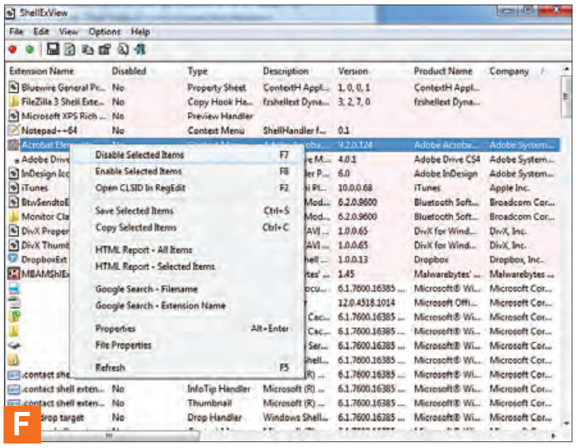
1 INSTALL SHELLMENUVIEW AND SHELLEXVIEW

First, you're going to need to download the utility from NirSoft. Just hit up the ShellMenuView page at www.nirsoft.net/utils/shell_menu_view.html and scroll to the download section near the bottom of the page. Grab the appropriate installer (make sure to grab the x64 installer if you're running a 64-bit version of Windows) and extract ShellMenuView to wherever you keep your program files.

Do the same for ShellExView—it's located at www.nirsoft.net/utils/shexview.html.

2 ADD/REMOVE MENU ITEMS

So, now that you've got ShellMenuView installed, all that's left to do is



F

run it. When you do, you'll be greeted with a long, long list of context menu options (image E). Any command you'd like to remove should be in this list; the trick is in finding them.

To disable a command, just select it, and click the red circle at the top of the page. For more options, including a very detailed information panel, right-click the command. A disabled command can be re-enabled at any time—simply select it and click "enable."

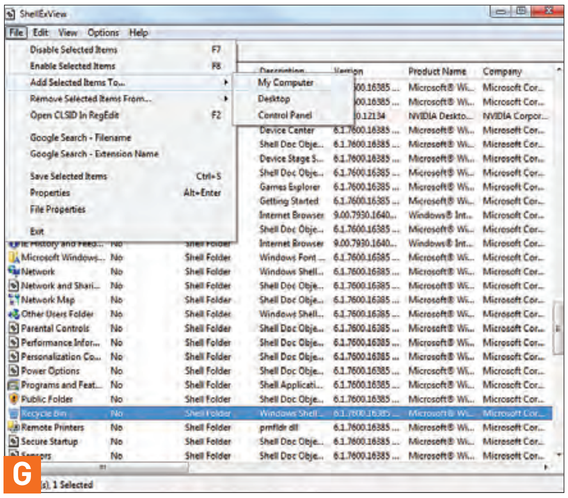
3 ADD/REMOVE SHELL EXTENSIONS

If you tried ShellMenuView but you're still stuck with an unwanted context menu behavior, you might be dealing with a shell extension, rather than a simple context menu option. A shell extension can change more than just the basic context menu options. It could, as a simple example, change the drag-and-drop options that pop up when you right-click and drag a file. To deal with these, we'll use ShellExView.

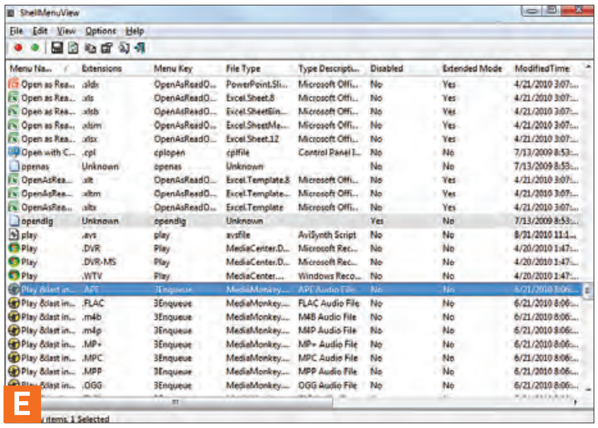
Functionally, it works exactly the same as ShellMenuView. Just run it, and try to track down your rogue process (image F). It can be difficult to find a particular third-party shell extensions among the tons and tons of default Windows ones, so it helps to sort the list by the Company field.

4 BONUS STEP: CUSTOMIZE YOUR MY COMPUTER FOLDER

Here's a cool bonus feature of ShellExView: The folders that show up in your My Computer folder and on your desktop are regulated by shell extensions. That means that we can use ShellExView to customize what shows up in those locations.



G



E

To do so, start up ShellExView, and filter the extensions by Type. Scroll down to the extensions of the Shell Folder type. These extensions (as you might expect) control certain special folders, like the Recycle Bin and the Network Places. To add one of these folders to My Computer, the desktop, or the control panel, simply select the extension, click the File menu at the top of ShellExView, scroll down to the option marked "Add Selected Items To…", and then select the location you want (image G).

Glorified rubber bands suspend your hard drive so it never touches metal. No metal-on-metal contact, no vibration. No vibes, no noise. Got it?

device into a 5.25-inch extravaganza. I'd much rather keep the system's primary drive nice and cool in the proper drive bay area of the case—right in front of a fan—as opposed to the fanless 5.25-inch bay section.

... AND THEN THE FUN BEGAN

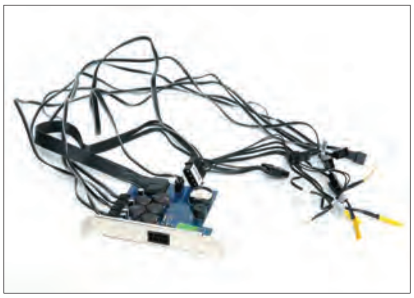
Using the same logic as I did for the CPU cooling, I opted to pick up Zalman's aftermarket VF3000F cooler for the system's Nvidia GTX 480 graphics card. A flashy heatsink coupled with two 92mm fans for cooling should, in theory, allow the card to hit lower temperatures and cut down on the GTX 480's infamous noise production.

I'll go over how one actually installs an aftermarket cooler in the sidebar on page 70. Just know that it is a far more difficult process than that of an aftermarket CPU cooler. With the GTX 480 in particular, it's maddening. As other online forum posters have noted, Nvidia has really applied a ton of torque to the super-tiny screws it uses to connect the videocard's proprietary heatsink to its circuit board, so much so that I completely stripped one of the screws when trying to remove it from the graphics card.

What do you do in this kind of situation? Cry. Because nothing short of drastic measures—including an attempt to superglue a screwdriver into the bored hole that was once a Phillips head—is going to get that screw out. In my case, I strapped on my +10 Goggles of Bravery, took a brief detour down to the hardware store a few minutes before it closed, and picked up a drill and a 1/16-inch bit. I bored a hole through the screw while visions of destroyed electronics and angry editors flashed through my head.

The new GPU cooler ended up working out just fine. I then attached the cable for its fans—and every other fan in the case—to my final, secret weapon: the NZXT Sentry LXE five-fan controller.

The beauty of this device is twofold: It provides detailed precision over exactly how much juice the cooling devices receive and, more importantly, it does so via a wicked touch-screen panel that you can stash just about anywhere you'd like. With but the press of a finger, you can adjust your fans for any situation.



The worst thing about NZXT's Sentry LXE is its medusa of cables and thermal probes.

SO, HOW DID I DO?

Ultimately, my silent build was both a win and a loss. My work did indeed improve acoustical performance over my default Maximum PC test bed, which has stock coolers, no aftermarket accessories, and standard fans in an NZXT Panzerbox case. Using a Digital Sound Level Meter by Extech Instruments—which starts its measurements at 40 decibels—I clocked significantly higher sound readings from all measured portions of the Panzerbox chassis versus my customized rig.

I also beat the results of the exact same system built in the soundproofed R3 case from Fractal Design, although not by quite as much as I had hoped, save for the hurricane of sound coming from the rear of the

Yes, Virginia, that's a touch-sensitive display. Control your fans with your fingers to totally customize your cooling.

LENGTH OF TIME
3 HOURS

LEVEL OF DIFFICULTY
INTERMEDIATE

BUILD IT
A Silent Gaming PC

Can we build a PC that's quiet and cool without sacrificing performance—or spending a fortune?

DAVID MURPHY
CONTRIBUTING WRITER

THE MISSION Anyone can build a gaming PC. Seriously, it's easy. Minus a few technological bits of know-how here and there, there's really nothing that tough about buying the fastest components you can afford and slapping them in whatever chassis you happen to have on hand. Done, right?

Maximum PC never shies away from a challenge, however, and Sr. Associate Editor Nathan Edwards has upped the ante for this month's build-it. One of the key problems of building a tricked-out rig is that you're sure to increase the ambient volume of the system as you increase its power. But I'm not here for a trade-off: No, I've accepted the challenge to build a gaming system that's as quiet as a mouse.

Spoiler: It's a lot harder than it seems.

INGREDIENTS

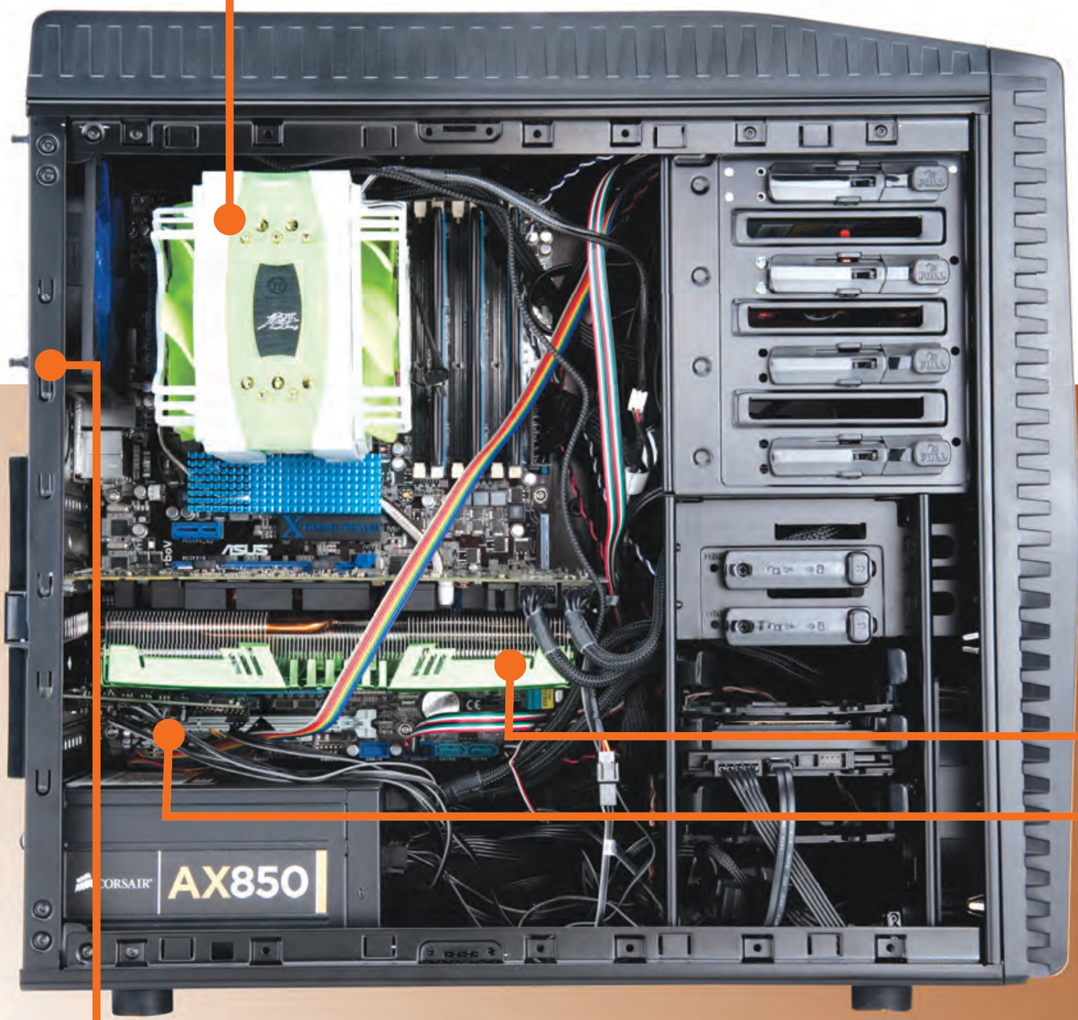
Case Silverstone PS05	www.silverstone.com	$50
PSU Corsair AX850	www.corsair.com	$190
CPU Intel Core i7-930	www.intel.com	$300
CPU Cooler Thermaltake Jing	www.thermaltake.com	$60
RAM Corsair TR3X6G1600C7 DDR3/1600 6GB Kit	www.corsair.com	$125
Optical Drive Plextor PX-805SA	www.plextor.com	$100
Boot Drive WD VelociRaptor 600GB	www.wdc.com	$280
Storage Drive Seagate Barracuda XT 2TB	www.seagate.com	$170
GPU EVGA GeForce GTX 480	www.evga.com	$450
GPU Cooler Zalman VF3000F	www.zalman.com	$65
Fan Controller NZXT Sentry LXE	www.nzxt.com	$60
Soundproofing Foam FrozenCPU Dampening Material	www.frozencpu.com	$20
Misc NoiseMagic NoVibes III Hard Drive Silencer	www.frozencpcu.com	$23
OS Windows 7 Professional 64-bit OEM	www.microsoft.com	$140
Total for Sound-Dampening Parts (incl. case)		$278
Total for PC		$2,033

Choosing the Right Hardware

The backbone of my proposed gaming PC is fairly standard: a Core i7 CPU paired with an Nvidia GTX 480 videocard. That is more than enough to frag my friends in any title I toss at it, and more to the point, if you already own a PC you want to hush, these are parts that a *Maximum PC* reader could very well have. Of course, you don't need these exact components—though the total cost of my silenced rig exceeds $2,000, the cost for the sound-damping materials (including case) is less than $300, and you can easily apply those materials to the PC you already have.

There's no shortage of devices that promise awesome performance at an ultra-low acoustic profile. My plan was to stick as many quiet-themed products in my PC as possible—including a silent CPU cooler, an aftermarket cooler for my videocard, quieter fans, and as much acoustic padding as I had room to mount into the case.

But that's not all. For comparison's sake, I also decided to build a rig inside of Fractal Design's R3 chassis—a $120 case that arrives on your doorstep pre-configured for silence (see review on page 88). Besting this quiet beast was my secondary goal.



THERMALTAKE JING With two 12cm fans to push air over the heat fins, it's a much quieter cooler than the stock Intel model that came with our CPU.

ZALMAN VF300F This aftermarket GPU cooler replaces the hot-and-noisy stock cooler of our EVGA GeForce GTX 480 with something larger and quieter.

FAN CONTROLLER The inside of our case looked a lot cleaner before we inserted the PCB for our fan controller (and its tangle of fan cables and temperature probes).

SMALL EXTRAS Rubber mounting pegs rather than screws cut down on fan-vibration noise.

Fractal's chassis.

However, here's the kicker: My system did not perform nearly as well against either rig in the recorded temperature tests. What I gained in acoustical excellence, I traded off in higher temperatures. This fact couldn't have been made any clearer than when I ran an unofficial test to see if I could kick up the thermal performance of my hand-built rig. I cranked all of the system's internal fans (save for the aftermarket GPU cooler) to maximum and my recorded temperatures still couldn't match either my test bed or the Fractal R3–based system.

Fractal's R3 case is a crafted beauty, offering easy installation and preset soundproofing material for folks looking for a good off-the-shelf, silenced solution.

Extech's 407727, which we found in the Lab, is a good sound-level meter, but it can't match ultra-sensitive professional models, which cost about 40 times the price.

AFTERMARKET ADD-ONS

How to Install an Aftermarket GPU Cooler: Very Carefully

An aftermarket GPU cooler is exceedingly complicated to install, and you run the risk of bricking your card if you do it wrong. Here's the gist: You unscrew the stock heatsink on the card via the super-tiny screws on the underside of the card. Take care not to bend or otherwise grip your card too tightly and, for the love of all things holy, be gentle—but forceful—when removing the tiny screws.

You'll have to clean off the GPU (rubbing alcohol works great) and likely apply more thermal paste to it and to any of the other raised components that touch your new heatsink. You'll also have a complicated series of washers, standoffs, and screws to fiddle with as you mount your new cooler in place—this varies based on the aftermarket cooler you're using. No matter what, be careful: A videocard is a delicate object. Snap off or otherwise bump the wrong electronic element, and you'll find yourself with a $300 coaster… or worse.

Note the sheer size difference between the card's stock heatsink (far left) and our aftermarket cooler on the right. Goodbye, noise!

Taking a videocard down to its raw components—a circuit board and chip, in this case—is an extremely delicate process. You can easily brick a PC part.

Putting It All Together

Staring at an empty case can be a daunting moment for the would-be soundproofer. Every part of the building process must be meticulously planned to avoid inducing rage and/or headaches caused by backtracking. The last thing you want is to try tacking acoustical foam all around a chassis once you already have your parts and wiring in place. I cannot think of a greater frustration than that, save for stripping the super-tiny screw on a videocard. More on that later.

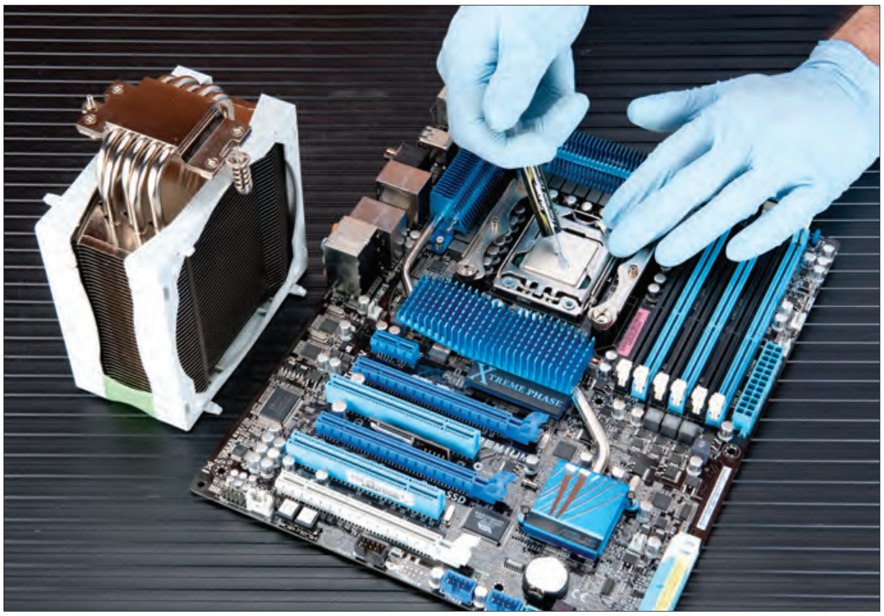
Because of this, it's really important to start this kind of build by determining how much soundproof padding you're going to need and where you're going to place it. You can pick up acoustical foam in a variety of configurations and sizes. Without getting too much into the intricate details, a simple rule of thumb is that more foam equals more soundproofing. Yes, you can buy super-fancy foam packs that are composed of multiple layers of various densities, but a single ordinary (albeit thick) density is fine.

Mounting the foam in my case was a relatively simple process. (See the sidebar on page 68 for a full rundown.) Next, I installed two 12cm fans into the chassis, using their included rubber fasteners rather than metal screws to adhere them to the case. The more I can cut down on unnecessary vibrations, the better.

Although I intended to use some Yate Loon D12SM-12C fans, the 1,500rpm Silverstone fans that shipped with my chassis actually turned out to be a little quieter in an impromptu head-to-head contest. As always, the rear fan on the case was installed to push air out of the case, with the front fan sucking air in across the hard drive bays.

I tossed in the system's standard DVD burner to reward myself for my efforts thus far before tackling the elephant in the room: the aftermarket Thermaltake Jing CPU cooler that I picked up to replace the stock Intel cooler. Thoroughly describing how to install this particular add-on would require an article in itself. The short version is that it involved such enjoyable tasks as using two different cleaners to wipe thermal goop off the CPU; installing all sorts of screws, dividers, and other such accessories just to mount

You have to be careful, yet firm, when pulling the rubber fasteners through the fan and case. Too much pressure and you'll rip the rubber fastener in two.



The Jing's two fans pop off easily, which is good because you can't install the cooler when they're mounted.

NEVER BUILT A PC BEFORE?

Your case, motherboard, and cooler all come with useful instructions, but be sure to check out our most recent step-by-step guide at http://bit.ly/bldcreed.

Sounding It Out

There are three key elements that you have to concern yourself with—above all others—when crafting a quiet PC: acoustic foam, fans, and the case itself. I think I did the best job possible with the foam, although I can appreciate the design of the pre-configured-for-silence Fractal R3. Because that case has a front door with side vents, air can be drawn in from the sides of the front panel while enabling the interior of the door to be fully covered with acoustic-damping foam.

Regardless, were I to do it again, I'd roll my own chassis in a heartbeat. However, next time I'll select a chassis that allows me to use larger fans across all measured areas. A larger fan, after all, allows you to push more air at a lower speed, giving you the best of both worlds: less noise and increased cooling. I would also give myself more room for even thicker soundproofing foam where possible, to ensure the best possible trade-off of exposed space for cooling versus completely covered space for silence.

The noise levels of the aftermarket GPU and CPU coolers met my expectations. But I was surprised by the CPU cooler's lack of, well, cooling. I wasn't expecting a miracle, but I did have hopes that it would perform better than the stock cooler. I suspect a lack of external airflow into the case to be the primary culprit—with only one intake fan, the PS05 is hard pressed to provide the intake the Jing cooler needs. GPU temperatures weren't recorded with the aftermarket GPU cooler, since we removed the onboard temperature sensor with the stock heatsink.

I would veer away from using special mounts for hard drives, preferring instead the simple rubber fasteners that give you some protection against vibration without forcing you to stash your hard drive in a different-size bay entirely. I'm not sure the trade-off of cooling loss versus potential acoustic savings was worth the effort or cost.

Overall, I'm pleased with my results. My system's temperatures were a touch higher, but it's a small price to pay for a stacked rig that purrs like a kitten when I fire it up. The NZXT fan controller single-handedly made this challenge a success, if for nothing else than allowing me to test cooling against acoustics on-the-fly. I highly recommend adding it to the top of your shopping list. The bottom line is that silence doesn't come easy, and a truly noiseless PC doesn't ever come cheap.

Just about any case can be quieted with the use of sound-damping materials and anti-vibration mounting—our Silverstone PS05 is quiet, but doesn't look stuffy.

BENCHMARKS

	Sound-Dampened PC	Fractal R3 PC	Stock PC
Temperatures (C)			
CPU Temp (idle)	47.25	39	**36**
CPU Temp (max)	83.75	77.75	**76.5**
GPU Temp (idle)	no reading	40	**36**
GPU Temp (max)	no reading	92	**85**
HDD Temp (Barracuda)	37	26	**24**
HDD Temp (Raptor)	33	**25**	26
Sound (dB)			
Front (min/max)	**Low / low**	**Low / low**	56.1 / 58.2
Side (min/max)	**Low / low**	Low / 44	51.3 / 55.6
Top (min/max)	**Low / 40.1**	Low / 42.1	54.5 / 56.8
Rear (min/max)	**Low / 43.4**	56.5 / 60.6	64.5 / 68.8

All temperatures measured using HWMonitor. CPU temps measured after an hour of inactivity and an hour of full CPU load. GPU temps measured after two successive iterations of the Heaven benchmark at maximum settings. Acoustics measured using Extech 407727 SLM at 6 inches from center of panel. Min and max levels recorded; "low" indicates sub-40dB.

REVIEWS

Tested. Reviewed. Verdictized.

INSIDE

74 FALCON NORTHWEST MACH V

76 EVGA GEFORCE GTX 580 SC VIDEOCARD

77 SAMSUNG 470 SERIES 256GB SSD

78 17-INCH NOTEBOOKS: HP ENVY 17, SAMSUNG RF710

80 ASUS EAH6850 DIRECTCU VIDEOCARD

81 ZALMAN CNPS9900 MAX COOLER

82 ANDROID TABLETS: SAMSUNG GALAXY TAB, VIEWSONIC VIEWPAD 7

84 ZOTAC ZBOX HD HTPC

86 GAMING SPEAKERS: ANTEC ROCKUS 3D SPEAKER SYSTEM, CORSAIR SP2500 GAMING AUDIO SPEAKERS

88 FRACTAL DESIGN DEFINE R3 CASE

90 SENNHEISER COMMUNICATIONS PC 333D G4ME HEADSET

91 CALL OF DUTY: BLACK OPS

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Falcon Northwest Mach V

Sandy Bridge and GeForce GTX 580 appear

Who came up with the concept of a vertically oriented motherboard that positions the graphics cards upright so the tremendous heat they generate vents straight up?

It's hard to say who first had the idea—we've seen cases that feature this design, and the Main-Gear Shift PC that we reviewed in June 2010 took the same approach. But Falcon Northwest claims it had a stake in the original idea and has even provided time-stamped images of its prototypes of the inverted design from 2002. That certainly predates the aforementioned examples, as well as Voodoo's luxurious but elusive Omen.

So, why the delay in finally getting a vertical design out? Falcon says exorbitant tooling costs prevented its prototype case from going into production, but the company is happy to finally have an inverted design out now.

The new Mach V's case is an improved version of Silverstone's Raven RV01 (the same vendor Falcon says it worked with on a vertical case years ago). The customizations include a 10cm fan on the back of the motherboard tray to cool the voltage regulators. Falcon says airflow testing also showed that the GPUs needed far more of a push from the 18cm fan at the bottom of the case and thus a baffle is used to shunt all of the air directly to the GPUs. Falcon also decided to locate the radiator for the Acetek cooler low and added an inlet so cool exterior air is sucked in rather than hot air hitting it on the way out.

Falcon Northwest's new Mach V case gets vertical.

The end result is an amazingly quiet machine considering the performance punch the Mach V provides. Much of that punch comes from Intel's brand-spanking-new Core i7-2600K chip. Overclocked from its stock 3.4GHz to 4.7GHz, the Sandy Bridge CPU is paired up with not one, but two Kick Ass award–winning GeForce GTX 580 cards. Falcon keeps storage fairly simple with a 1TB Western Digital Black drive and a 240GB OCZ Revo X2. The latter isn't a typical SSD, but rather four small SSDs RAIDed together and running off PCI Express and using the killer SandForce controllers. Its specs purport stupid-fast speeds in the 700MB/s range, and it certainly felt that damned fast in our tests.

In raw performance, we wondered how the Falcon would stack up against the army of Core i7-980X hexa-cores and tri-SLI and even quad-SLI configs we've tested of late. The Mach V did surprisingly well, considering that we're talking about four cores taking on six.

Normally, Falcon Northwest comes into the room and tap, tap, freaking slays bodies, but this configuration of the Mach V comes in at $4,295. That's damn near budget pricing for one of its rigs. It's also about $3,000–$6,000 less than some of the super-rigs we've had in our Lab. The closest competitor was the similarly priced Velocity Micro Edge Z55 that we reviewed in December. Equipped with a 3.2GHz Core i7-970 hexa-core (overclocked to 4.3GHz), it was nearly the equivalent of the Falcon in application performance thanks to its six cores. But the price of that hexa-core meant less RAM and lower-end GPUs than the Mach V offers. And, no surprise, the Mach V's GTX 580s absolutely spank the pair of GTX 460s in the Edge Z55.

Overall, the Mach V is a solidly designed, solidly spec'd machine with no holes that we can see. Yes, it might lack the sex appeal of the uber-machines we've encountered lately, but it's a lot more down to earth in pricing, too. —GORDON MAH UNG

SPECIFICATIONS

Processor	Intel 3.4GHz Core i7-2600K Overclocked to 4.7GHz
Mobo	Asus P8P67 Deluxe
RAM	16GB DDR3/1333
Videocard	Two GeForce GTX 580
Soundcard	Onboard
Storage	240GB OCZ Revo EX2, 1TB Western Digital Caviar Black 7,200rpm
Optical	LG 10x Blu-ray burner (WH10L530)
Case / PSU	Custom / Silverstone ST1000

BENCHMARKS

	ZERO POINT	
Vegas Pro 9 (sec)	3,049	2,313
Lightroom 2.6 (sec)	356	271
ProShow 4 (sec)	1,112	830
Reference 1.6 (sec)	2,113	1,587
STALKER: CoP (fps)	42.0	86.1 (+105%)
Far Cry 2 (fps)	114.4	173.9

0 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a quad-core 2.66GHz Core i7-920 overclocked to 3.5GHz, 6GB of Corsair DDR3/1333 overclocked to 1,750MHz, on a Gigabyte X58 motherboard. We are running an ATI Radeon HD 5970 graphics card, a 160GB Intel X25-M SSD, and 64-bit Windows 7 Ultimate.

MAXIMUMPC KICK ASS!

VERDICT 9

FALCON NORTHWEST MACH V

+ GRACE PARK	– PEOPLE'S PARK
A quad-core that can almost run with the hexa-cores.	16GB of RAM is a bit overkill.

$4,295, www.falcon-nw.com

EVGA GeForce GTX 580 SC

What Fermi was always meant to be

Nvidia's latest GPU release, the GF110, is essentially a re-engineered version of the original Fermi chip, with the addition of a few tweaks. By re-spinning the original, the full potential of Fermi is now realized, with all 512 compute cores active. (The original GeForce GTX 480 had the same number of compute cores, but 32 of them were deactivated.) Besides that, the GF110 features other enhancements, like improved FP16 texture performance, which boosts the frame rate in scenes using high dynamic range (HDR) rendering. The new chip also clocks higher; reference cards run at 772MHz core and 1,000MHz memory.

EVGA's GeForce GTX 580 SC version of the card juices the clock speeds a bit, with the core running at 797MHz and the memory at 1,012MHz. The clocks don't come free, though. The EVGA card's power consumption was a bit higher over the reference card at full throttle; in our tests, power at load came in at 395W, versus 385W for the reference GTX 580. That's also higher than the power consumption of the original GTX 480, but Nvidia likes to stress that "performance per watt" has improved.

Despite its incomplete nature, the GTX 480 was the fastest single-GPU card available; the extra compute cores, plus the higher clocks, allows the GTX 580 to considerably up the performance ante.

We popped EVGA's new progeny into our reference test system and took it for a spin. The result was a clean sweep across the benchmark board, as the GTX 580 easily trumped the performance of its predecessor as well as the top two single-GPU AMD products. In fact, when we dropped in a dual-GPU Radeon HD 5970, the GTX 580 still won in the majority of tests, and the difference was marginal in those benchmarks the HD 5970 won. So, not only is the GTX 580 the fastest single-GPU card you can get, it's pretty much the fastest card, period.

As with other Nvidia-based cards, you also get Nvidia's PhysX GPU physics feature in the games that support it. And if you're willing to dig deeper into your wallet, you can pick up a 3DVision kit for stereoscopic 3D gaming and movies, provided you have the requisite 3D LCD with a 120Hz refresh rate. Unlike AMD, however, you'll need a second card if you want to drive more than two displays.

The GTX 580 costs a pretty penny: The lowest price we've seen is around $540. So, if you're burning for the fastest graphics card you can get, and have the power supply to handle it, you'll have to pay for the privilege. AMD enthusiasts may like to play the efficiency card, but sometimes we just crave raw speed. **—LOYD CASE**

BENCHMARKS

	EVGA GTX 580 SC	Asus ENGTX 480	XFX Radeon HD 5870 XXX	XFX Radeon HD 6870
3DMark Vantage Perf	**23,888**	18,183	19,282	17,068
Unigine Heaven 2.1 (fps)	**36**	30	17	19
Crysis (fps)	**40**	31	33	29
BattleForge DX11 (fps)	**76**	63	49	44
Far Cry 2/Long (fps)	**122**	103	78	78
Metro 2033 (fps)	**26**	21	2	13
HAWX DX10 (fps)	**130**	104	92	73
STALKER: CoP DX11 (fps)	**58**	44	38	34
Just Cause 2 (fps)	**52**	47	37	35
Aliens vs. Predator (fps)	**44**	36	31	27
Dirt 2 (fps)	**114**	91	73	65
HAWX 2 DX11 (fps)	**158**	145	64	72
Power@ idle (W)	141	153	142	**129**
Power @ full throttle (W)	395	357	290	**254**

Best scores are bolded. Our test bed is a 3.33GHz Core i7-975 Extreme Edition in an Asus P6X58D Premium motherboard with 6GB of DDR3/1333 and an 850TX Corsair PSU. The OS is 64-bit Windows 7 Ultimate. All games are run at 1920x1200 with 4x AA. Note that lower numbers are better for power consumption.

VERDICT 9

EVGA GEFORCE GTX 580 SC

+ APERTURE SCIENCE	− UMBRELLA CORPORATION
Unbeatable gaming performance; full Fermi capabilities unleashed.	Really expensive; steep power draw at full throttle.

$540, www.evga.com

EVGA delivers a slightly tweaked GTX 580, making the fastest single GPU a little faster—albeit at a steep price.

17 Inches of Slim

Proof that desktop replacements don't have to be back-breakers

We're all familiar with the gigantoid 17-inch notebooks that practically require a crane for lifting and barely exceed a half-hour on battery. While often powerful beasts, those machines are far from portable. This month, we take a look at a couple of 17-inch notebooks that are particularly slim, not to mention stylish. Do their aesthetic attributes make them any less viable as desktop replacements? Let's find out. –KATHERINE STEVENSON

The Envy 17's attention to design and detail make it the PC equivalent to an Apple MacBook.

HP ENVY 17

The Envy 17 is the biggest and most powerful model in HP's top-end line of laptops, which are known for their sex appeal and solid build quality. The Envy 17's 11x16.5x1.5-inch chassis is constructed of magnesium alloy with an aluminum wrapping that's decoratively etched on the lid and palm rest. The chiclet keyboard is large, with a dedicated number pad, and the keys feel pleasant to type on. The keyboard's backlight can be turned on and off with a key press. The Envy 17 also features a ClickPad, an enlarged touchpad that incorporates the right and left buttons under the same roof. The pad supports multitouch gestures, which can be a mixed bag—two-finger scrolling just never seems as responsive as one-finger edge motion. Two solid metal hinges connect the body to a 17.3-inch, 1920x1080 screen featuring edge-to-edge glass. It all makes for a handsome package.

While the Envy 17 boasts a slender profile, it's not dainty in terms of weight—it's 7 pounds, 8 ounces without the power brick—or in terms of computing power. The 1.6GHz Core i7-720QM processor features four distinct cores, along with HyperThreading and Turbo capability up to 2.8GHz in lightly threaded apps. That's sufficient might to overtake our zero-point rig's 3.06GHz Core 2 Duo in the content-creation benchmarks, most by significant margins.

In games, the Envy 17's AMD Radeon Mobility HD 5850 stands up to the GTX 260M in our zero-point rig, with comparable scores in both Far Cry 2 and Call of Duty 4. The HD 5850, however, has the distinction of supporting AMD's Eyefinity multi-display technology, allowing us to connect three external monitors to the notebook's HDMI, Mini DisplayPort, and VGA connectors. We tested the feature running the Dirt 2 demo benchmark across three 1920x1080 monitors, with a combined resolution of 5760x1080. We kept all settings at High and achieved an average frame rate of 17.3fps. That's a playable frame rate for a game of this type, and three screens certainly adds drama to the racing action, but results will no doubt vary among titles.

Another trick up the Envy 17's sleeve is Beats Audio—a digital music playback profile developed by HP and Interscope Records. The difference in sound quality with and without Beats enabled is dramatic—although the "without" state is particularly anemic. Still, we'll admit that Beats Audio makes music sound pretty damn good on a notebook, especially through an external set of speakers or headphones.

SPECS HP ENVY 17

CPU	1.6GHz Intel Core i7-720QM
RAM	8GB DDR3/1333MHz
Chipset	Intel HM55
Drives	Samsung 640GB 7,200rpm HDD, Intel 160GB SSD
Optical	Blu-ray ROM / DVD+/-RW
GPU	ATI Mobility Radeon HD 5850
Connectivity	HDMI, VGA, Mini DisplayPort, Ethernet, one USB 2.0/eSATA, two USB 2.0, one USB 3.0, headphone out, mic, 5-in-1 media reader, webcam, Bluetooth, 802.11g
Lap/Carry	7 lbs, 8 oz / 9 lbs, 2 oz

BENCHMARKS HP ENVY 17

	ZERO POINT	HP Envy 17
Premiere Pro CS3 (sec)	1,320	953
Photoshop CS3 (sec)	153	142
ProShow Producer (sec)	1,524	967
MainConcept (sec)	2,695	2,023
Far Cry (fps)	32.7	32.6 (-.2%)
Call of Duty 4 (fps)	58.2	57.8 (-.7%)
Battery Life (min)	100	58 (-42%)

0 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point notebook is an iBuypower M865TU with a 3.06GHz Core 2 Duo T9900, 4GB DDR3/1066, a 500GB Seagate hard drive, a GeForce GTX 260M, and 64-bit Windows 7 Professional. Far Cry 2 tested at 1680x1050 with 4x AA; Call of Duty tested at 1680x1050 with 4x AA and 4x anisotropic filtering.

The Envy 17 also features an especially nice screen, which is bright, produces vivid colors, and has good off-axis visibility. It's a nice complement to the notebook's Blu-ray reader. But don't count on watching even standard-def DVDs on the notebook's battery. We only got 58 minutes of runtime in our battery-life test using the Power Saver mode. It should also be noted that in both games and movie playback, the notebook gets pretty hot.

But even with its few shortcomings, there's an awful lot to like about the Envy 17. It's good-looking, well built, and capable of performing the gamut of desktop functions to varying degrees of satisfaction, while remaining reasonably portable.

VERDICT	
HP ENVY 17 $2,210, www.hp.com	**9**

SAMSUNG RF710

If we hadn't just spent time ogling HP's Envy 17, we might have appreciated the Samsung RF710's aesthetics more. After all, it too sports a sleek, sophisticated design. It's just that everything about the RF710 looks low-rent compared to the Envy 17. That's not so surprising, considering that the RF710 costs more than $1,000 less. The two notebooks have nearly the exact same dimensions, but the RF710 is a pound or so lighter. That's because, rather than sporting an all-metal chassis, as the Envy 17 does, the RF710 is primarily plastic. It's made to look nice, with a metallic finish offsetting the chiclet keyboard, and a glossy black finish on the lid and screen bezel—which will unfortunately be marred by fingerprints in short order.

The screen itself is also of a lesser quality, with a lower resolution of 1600x900 and noticeably less-vibrant colors. You can connect the RF710 to a larger display using either its HDMI or VGA port, which might do better justice to the Blu-ray movies you can play in the notebook's optical drive.

Fortunately, Samsung didn't skimp on its processor. The RF710 boasts the same 1.6GHz Core i7-720QM that we found in the Envy 17, and therefore achieved similar leads over our zero-point in the content creation benchmarks—and one inexplicably large lead in ProShow, a result that was replicated in a second run.

In gaming, the RF710 performed adequately. Its Nvidia GeForce GT 330M ran toe-to-toe with the Envy 17's HD 5850 in Far Cry 2, our more demanding gaming benchmark, but it was blown away by the HD 5850 in Call of Duty 4. Either way, you're looking at a notebook that's going to do its best gaming on older titles.

But for the price, the RF710's trade-offs seem reasonable. It might not be constructed of premium materials, but it still seems well made. It offers robust processing power and decent gaming capabilities in a slim profile, and an easy-to-access free drive bay makes it possible to add extra storage. It also comes complete with two USB 3.0 ports. If you're looking for a well-rounded machine at a budget price, the RF710 fits that bill.

SPECS SAMSUNG RF710

CPU	1.6GHz Intel Core i7-720QM
RAM	4GB DDR3/1066MHz
Chipset	Intel HM55
Drive	Seagate 640GB 5,400rpm
Optical	Blu-ray ROM / DVD+/-RW
GPU	Nvidia GeForce GT 330M
Connectivity	HDMI, VGA, Ethernet, two USB 3.0, two USB 2.0, mic in, headphone out, 4-in-1 media reader, webcam, Bluetooth, 802.11g
Lap/Carry	6 lbs, 9.2 oz / 7 lbs, 9.2 oz

VERDICT	
SAMSUNG RF710 $1,150, www.samsung.com	**8**

BENCHMARKS SAMSUNG RF710

	ZERO POINT	
Premiere Pro CS3 (sec)	1,320	1,002
Photoshop CS3 (sec)	153	150
ProShow Producer (sec)	1,524	722 (+111.1%)
MainConcept (sec)	2,695	2,028
Far Cry (fps)	32.7	30.8 (-5.9%)
Call of Duty 4 (fps)	58.2	31.4 (-46.1%)
Battery Life (min)	100	95 (-5.0%)

0 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point notebook is an iBuypower M865TU with a 3.06GHz Core 2 Duo T9900, 4GB DDR3/1066, a 500GB Seagate hard drive, a GeForce GTX 260M, and 64-bit Windows 7 Professional. Far Cry 2 tested at 1680x1050 with 4x AA; Call of Duty tested at 1680x1050 with 4x AA and 4x anisotropic filtering.

A row of buttons above the RF710's chiclet keyboard let you control or mute volume and enable or disable Wi-Fi.

Asus EAH6850 DirectCU

Even overclocked, AMD keeps a lid on power consumption

Asus pops on a custom cooler, overclocks the Radeon HD 6850, and keeps the price in check. What more could we ask for?

Once upon a time, factory-overclocked graphics cards with custom coolers shipped a few months after the reference cards were out. So, you'd typically end up with a pricier, slightly faster graphics card to replace the one you might already own—not a particularly cost-effective scenario.

Today, we're seeing some customized cards ship at nearly the same time as reference cards. So it is with the Asus EAH6850 DirectCU. Asus takes its DirectCU feature, which runs the heat pipes directly across the GPU chip, pushes the clock speeds up slightly, and ships the card for roughly the same price as a stock HD 6850. Asus also bundles its voltage-tweak utility, which lets you change the voltage and push clock rates even higher, if you like.

Asus's DirectCU version of the HD 6850 defaults to a slightly higher clock speed than the reference card—790MHz versus 775MHz. The memory clocks remain the same, at 1GHz. In addition to the non-standard cooler, Asus changes up the output connectors, offering a pair of DVI ports (only one is dual-link), an HDMI port, and a full-size DisplayPort connector, instead of two Mini DisplayPort jacks, as in the reference card.

Such a small overclock—not even 2 percent—nets only slight frame-rate gains against a stock-clocked card. But what about that more important question—how does it fare against its Nvidia contemporaries?

As you can see in the benchmarks, it's actually a pretty close race between the overclocked Gigabyte GTX 460 and the EAH6850 DirectCU. The Nvidia-based Gigabyte card wins a few, the EAH6850 wins a few. Full-throttle power consumption, though, belongs to the AMD GPU all the way. Of course, Nvidia's GPUs offer stereoscopic 3D support through its 3DVision feature, while AMD is relying on third parties to deliver the technology. On the other hand, AMD's Eyefinity feature lets you connect up to three 1920x1200 pixel displays to the EAH6850 with just a single card. The choice comes down to which feature set is more important, rather than performance differences.

Pricing is pretty equivalent, too. We found one store offering the EAH6850 for $185, but most places seem to offer it for $200—right in the same ballpark as the 1GB GeForce GTX 460. The EAH6850 has efficiency on its side, but the performance of both cards and pricing are about even. Given that Radeon HD 6870s cost only $30–$40 more, we recommend going with the higher-end card. But if your budget is tight, Asus's take on the HD 6850 is rock-solid. —LOYD CASE

BENCHMARKS

	Asus EAH680 DirectCU	XFX Radeon HD 6850	Asus GTX 460 768MB	Gigabyte 460 GTX 1GB
3DMark Vantage Perf	14,510	14,292	13,737	**14,609**
Unigine Heaven 2.1 (fps)	15	16	**18**	**18**
Crysis (fps)	**25**	24	19	18
BattleForge DX11 (fps)	36	36	**38**	37
Far Cry 2 /Action (fps)	**57**	**57**	56	54
Far Cry 2 /Long (fps)	**69**	68	68	66
HAWX 2 DX11 (fps)	63	62	63	**65**
STALKER: CoP DX11 (fps)	29	28	25	**30**
Just Cause 2 (fps)	**31**	30	30	**31**
Aliens vs. Predator (fps)	**23**	**23**	21	22
Dirt 2 (fps)	58	57	60	**72**
Power@ idle (W)	**128**	133	**128**	131
Power @ full throttle (W)	**215**	218	248	251

Best scores are bolded. Our test bed is a 3.33GHz Core i7-975 Extreme Edition in an Asus P6X58D Premium motherboard with 6GB of DDR3/1333 and an 850TX Corsair PSU. The OS is 64-bit Windows 7 Ultimate. All games are run at 1920x1200 with 4x AA.

VERDICT 8

ASUS EAH6850 DIRECTCU

+ ARABICA	− ROBUSTA
Good performance; power efficient; three displays with one card.	Slightly pricier than stock cards; only a single DisplayPort connector.

$200, www.asus.com

Zalman CNPS9900 Max

Where did *this* come from?

We were ready to write Zalman off for good. Its much-beloved 9000-series copper heatsinks (culminating in the CNPS9900, which received a Kick Ass award in March 2009) were blown away by the advent of skyscraper-style coolers like the Thermalright Ultra-120. Zalman's attempt at a skyscraper-style cooler, the CNPS 10X, was a bust, aesthetically and thermally. But now, Zalman's returned to what it knows best: circular copper arrays surrounding a central fan. The CNPS9900 Max looks like a darker version of the CNPS9900. In this age of dual-fan skyscraper behemoths, can Zalman catch up?

At 3.7 inches deep by 5.15 inches wide by 5.9 inches high, the CNPS9900 Max is virtually identical to its predecessor. It, too, has three heatpipes—one in the front, two in the back—surrounded by two sets of heat-dissipating copper fins. The only real differences are the finish and the fan. The Max's fan is 13.5cm compared to the 12cm of its predecessor (and comes in either red-LED or blue-LED versions), and the Max has a smoky-black nickel coating, which has the possibly intentional side effect of making the fins much less likely to draw blood. The Max also ships with an included resistor cable to put the fan in quiet performance mode, but it's plenty quiet even without that cable.

Let's get this out of the way: First-time installation of the Max sucks. Its universal backplate system means you only need one backplate, but putting it together is a pain. You need four nuts (heh), four sliding nut retainers, and a square bit of double-stick foam for the backplate. Then you finagle four bolts with a proprietary hex head through the mounting brackets on the bottom of the heatsink and use an Allen wrench–like object to screw them in. Good luck installing it in your computer without taking out at least the graphics card. But once the Zalman CNPS9900 is installed? Holy cow.

We were shocked at how much ass the CNPS9900 Max kicks. On our current test system—our hottest by far—the CNPS9900 Max kept pace with the Prolimatech Armageddon in dual-fan mode. In fact, the Max was slightly cooler. Maybe it's the bigger fan, or the composite heatpipes. Or maybe Zalman just found a box labeled "magic" in the basement. Whatever the reason, we're pleased to welcome Zalman back into the top ranks of air-cooling. Our only complaint concerns the tricky installation process—Prolimatech's approach is still vastly superior. At $80, the CNPS9900 Max is a bit on the pricey side, but for top-tier performance in a familiar (yet not skyscraper-shaped) package, we'll spring for it. –NATHAN EDWARDS

BENCHMARKS

	Zalman CNPS9900 Max	Prolimatech Armageddon (2 fans)	CM Hyper 212+
Idle (C)	**34**	34.25	35.25
100% Burn (C)	**58.75**	59.25	67

Best scores are bolded. Idle temperatures were measured after an hour of inactivity; load temperatures were measured after an hour running Intel's internal Lynnfield thermal testing utility at 100 percent load. Test system consists of Intel Core i5-750 overclocked to 3.2GHz on an Asus P7P55D Premium board in a Corsair 800D case with stock fans. Temperatures taken with HWMonitor.

MAXIMUMPC KICK ASS!

VERDICT 9

ZALMAN CNPS9900 MAX

+ ZIGGURAT
Top-tier performance; quiet; good looks; less sharp than its predecessor.

– ZAPP BRANNIGAN
Frustrating install; proprietary bolts.

$80, www.zalman.com

The two biggest differences between this cooler and its predecessor are the finish and the performance.

Android Tablet Tussle

The Galaxy Tab and ViewPad 7 trump a pack of woefully craptacular tablet contenders

Samsung's screen is a spec-busting 1024x600. Various custom apps make use of that larger resolution quite well.

Over the holidays, friends and family assaulted the *Maximum PC* editors with tablet questions. We mostly fielded softballs:

"Is the iPad really deserving of all its hype?"

Yes. We originally gave it an 8 verdict, but now with its new multitasking support, it would warrant a 9. The iPad is the perfect digital device for some very particular situations.

"Can any Android tablet compete with Apple's platform?"

No. But we haven't yet seen an Android device with more than 7 inches of screen real estate, and Apple's App Store offerings still make the Android Market look like a shanty town bazaar.

"So, is there any Android tablet worth buying yet?"

That was the one question that gave us pause. Samsung's Galaxy Tab and ViewSonic's ViewPad 7 had just arrived in the Maximum PC Lab, and impressed us with a level of fit and finish that was missing from earlier Android tablets. Neither of these new 7-inchers offers the screen real estate, UI simplicity, or kick-ass apps library of the iPad. Nor do they come with Android 2.3—though this latest OS version was only announced, and not yet available, at press time. Nonetheless, the Tab and ViewPad 7 hint at greater Android riches to come. **–JON PHILLIPS**

SAMSUNG GALAXY TAB

The Galaxy Tab is the most refined Android tablet we've tested, in large part thanks to its "Super TFT" screen. At 1024x600, this 7-inch display exceeds Android 2.2's maximum screen resolution of 854x480. While Android apps built to that standard spec are "upscaled" on the Tab's screen, we didn't notice any ugly pixel interpolation during testing. The Galaxy Tab's screen is sharp, bright, and categorically brilliant. True, we didn't test for color accuracy, but skin tones looked natural in HD movies (the Tab handles 1080p), and no one is doing Photoshop editing on a 7-inch screen.

The Galaxy Tab scored well in our Android performance benchmarks, easily besting the ViewPad 7 (see chart). The speed and responsiveness of the UI also trumped what we experienced with the ViewPad 7. This comes as no surprise, given the Galaxy Tab's superior processing engine (its greater screen-resolution demands notwithstanding). The Tab is armed with Samsung's own 1GHz "Hummingbird" system-on-chip, which integrates a PowerVR graphics unit. This is essentially the same processing duo you'll find in an iPad, but the Galaxy Tab's UI doesn't match the quick scrolling and screen redraws of the iPad (which has an even higher resolution of 1024x768).

Does the iPad have a leaner OS? Better optimized application code? These are questions for the forensics team. We just know that even the Galaxy Tab—the world's current-best Android tablet—has a markedly less-fluid interface.

But we do like what Samsung has done with the Tab's graphical iterations of the basic Android UI. In particular, the Calendar and Email apps have a more polished, friendly information design. You'll find tabbed panes for Day/Week/Month/List immediately exposed in Calendar, as well as a very iPad-like Email app—especially in landscape view, with message headers in a left-hand column, and full message bodies on the right.

The Tab's industrial design is snoozy. The front face is entirely glass with a 5/8-inch black border skirting the perimeter. The remaining fascia is hard plastic in either black or white. The look is unremarkable, if inoffensive. A proprietary (d'oh!) 30-pin dock connector handles USB, HDMI, and power-charging duties. The front glass is host to a 1.3MP chat camera, and a 3MP camera graces the back.

Samsung makes only one Galaxy Tab model, and 3G data support is baked right in, thus explaining the company's decision to sell the tablet directly through phone carriers. The device costs $400 if you buy a data contract, and $600 if you decide to go commando—which we recommend because 3G isn't necessary in a tablet. We're already getting reamed for 3G smartphone fees, so we'll use our phones for Internet duties when Wi-Fi isn't available.

This leaves us with a $600 tablet that, when compared to the $630 iPad, offers less screen real estate, and a much less robust apps ecosystem. The Tab is a solid piece of hardware, yes, but do you really hate Apple so much that you won't buy an iPad?

VERDICT **8**

SAMSUNG GALAXY TAB
$600 (without contract), www.samsung.com

VIEWSONIC VIEWPAD 7

At first glance, the ViewPad 7 looks like an iPhone 4 that's been taking injections of gadget growth hormone. Like the latest iPhone, ViewSonic's tablet has rounded-off edges, a handsome metal band skirting its circumference, and a glossy-black backing plate. From an industrial design perspective, it's the slickest Android tablet we've tested. And, while the ViewPad 7 easily bests the Dell Streak and lesser Android tablets from a real-world use perspective, it falls short of Samsung's Galaxy Tab, and lags far behind the iPad.

The ViewPad comes up short in two crucial, high-profile areas: screen quality and UI performance. The 7-inch, 800x480 screen simply lacks brightness and color saturation compared to the Samsung Galaxy Tab and Apple iPad. What's more, text rendering—be it in the Android UI, a browser page, or a note-taking app—looks a wee bit fuzzy on the ViewPad 7. It's not awful, per se, but compared to other tablets, the difference is noticeable. As for the fluidity of the UI, it too is noticeably laggy compared to what you'll find in the more elite tablets. Quick scrolls through home screen windows and object-rich browser pages just don't have that effortless, "Whee! Away we go!" responsiveness that you'll experience with the iPad.

Compared to either the iPad or Galaxy Tab, the ViewPad 7 is hobbled in the processing department, which might help explain its graphical lethargy. ViewSonic opted for a 600MHz Qualcomm SoC, and in both benchmark results and real-world use, we found the processor lacking. Now, granted, this ViewPad 7 is still well ahead of other Android tablets in its ability to deliver a satisfying user experience in browsing, tweeting, emailing, and other tablet-appropriate activities. It just isn't top dog in the greater tablet universe.

What the ViewPad 7 does offer, however, is a friendly price and a completely telecom-free purchasing experience. The tablet does include 3G support, but ViewSonic isn't launching it with any subsidized pricing schemes, or obligations for data contracts. The MSRP is $480, and street pricing should drop as low as $430. That represents a significant savings over the iPad and contract-free Galaxy Tab, and might be just appealing enough for wannabe tabletistas to pull the trigger—especially those odd ducks who find the iPad "too heavy."

VIEWSONIC VIEWPAD 7
$480, www.viewsonic.com

VERDICT **7**

SPECIFICATIONS

	Samsung Galaxy Tab	ViewSonic ViewPad 7
OS	Android 2.2	Android 2.2
Processor	1GHz Samsung S5PC110 (Cortex A8 with PowerVR SGX540)	600MHz Qualcomm MSM7227
Memory	512MB	512MB
Storage	16/32GB on microSD	512MB onboard; 16/32GB on microSD
Display	7-inch, 1024x600, 169ppi	7-inch, 800x480, 133ppi
Cameras	1.3MP front; 3MP back with autofocus and LED flash	0.3MP front; 3MP back with autofocus
Connectivity	3G; Wi-Fi 802.11 b/g/n; Bluetooth 3.0; 30-pin connector for power, HDMI and USB 2.0	3G; Wi-Fi 802.11 b/g; Bluetooth 2.1; mini-USB connector for power and data transfer
Weight and Dimensions	13.4 oz; 7.5x4.75x0.4 inches	13.1 oz; 7x4.33x0.45 inches

BENCHMARKS

	Samsung Galaxy Tab	ViewSonic ViewPad 7
Quadrant	**1,010**	409
Linpack	**14.21**	7.44
Neocore	**53.9 fps (1024x600)**	35.3 fps (800x480)
BrowserMark	**25,303**	19,935
Battery Rundown	**6 hours, 53 minutes**	6 hours, 38 minutes

Best scores are bolded. Our battery rundown test entails fully charging each device, turning on Wi-Fi, setting brightness to 50 percent, and then running the animated start-up screen of Angry Birds until the tablets' screens die.

ViewSonic's industrial design is sophisticated, but its screen quality doesn't warrant any urgent tweets or Facebook Likes.

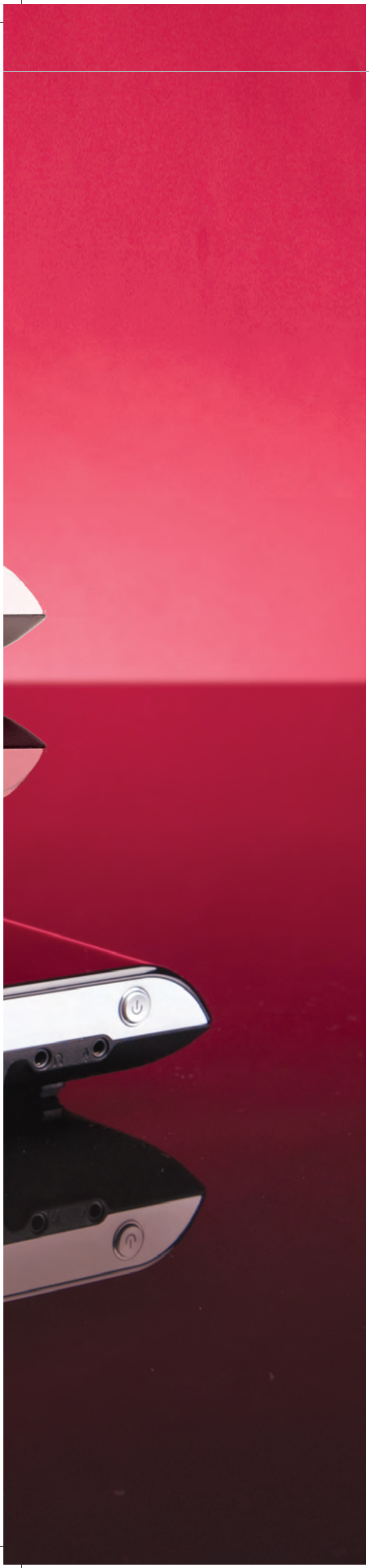
The Zotac is still serviceable for its size, and the company uses only one SO-DIMM, so there's room to add a second module.

SPECIFICATIONS

Processor	Intel 1.8GHz Atom D525
Mobo	Custom board using Intel NM10 Express
RAM	2GB DDR2/800
Videocard	Nvidia Ion 512MB
Soundcard	Onboard
Storage	250GB 2.5-inch Samsung HM250 hard drive
Optical	Slimtype DL4ETS Blu-ray combo
Case / PSU	N/A / 95-watt external power brick

A healthy dose of ports includes USB 3.0, Gigabit, DVI, HDMI, S/PDIF, and a combo USB 3.0 and eSATA port.

With Blu-ray and discrete Ion graphics, the Zbox HD puts dedicated streaming boxes to shame.



Zotac Zbox HD

Another option for cable-cutters emerges

Does the cable-cutter movement have a name yet? Yes, it's called, "I'm cheap as hell, and I don't want to pay for your 250 channels of garbage anymore!"

For those cable TV and satellite abandoners, we present to you Zotac's Zbox HD. Think of it as the ultimate streaming box. OK, we're exaggerating. It's not. It's really just a nifty, stylish PC made by Zotac. But it will certainly give you far more flexibility and options than any streaming box available today.

That's because as a PC, just about anything you can view in the browser, you can view on the TV. The Zbox HD includes an HDMI port, a DVI port, and optical S/PDIF outputs. In storage I/O you get a gigabit LAN port and—très cool on a HTPC—three USB 3.0 ports, one of which doubles as an eSATA port. There's a sole USB 2.0 port in front and also a slimline, slot-fed Blu-ray combo drive.

The guts of the Zbox HD are moderate. There's a dual-core 1.8GHz Atom D525 chip, 2GB of RAM, and an Ion graphics chip connected to the Intel NM10 Express chipset. Unlike prebuilt HTPCs from Dell, Polywell, and others, the Zbox HD ships as a DIY kit. It comes with drivers on a disc and an empty hard drive. You bring your own OS to get this mini-HTPC up and running.

Before we go on, we have to say that the world is a different place than it was in June 2010 when we reviewed Dell's Inspiron Zino. While the Zino could not handle HD Flash content or 1080p QuickTime, that was really the fault of Apple and Adobe. Today, with Flash 10.1's solid GPU acceleration, it's a different ball game.

The Zbox HD's 1.8GHz Atom D525 is, in our opinion, still a marginally weak CPU. The Nvidia Ion chip, however, does much of the lifting in HD content. We were able to watch Flash content in HD without issues. Blu-ray playback, which was problematic on Polywell's Giada Atom/Ion combo (reviewed in March 2010) also went without a hitch on the Zbox. Even nicer, Zotac includes an OEM version of PowerDVD with Blu-ray support in the box.

Getting an OS onto the machine was a bit of a head-scratcher, though. For our testing, we installed 64-bit Windows 7 Professional. But, with only one standard USB port and no PS/2 ports, we could not run a keyboard and mouse at the same time. To solve that problem we just alternated between mouse and keyboard, plugging in whichever one we needed. Once the OS was up and running, we installed the drivers to enable the USB 3.0 ports in the OS. Also confusing, Zotac includes driver discs for its Ion and non-Ion-based units in the box.

Performance is nothing to write home about. In "gaming" (if you can even use that term for the 8- to 12-year-old benchmarks we ran), the Zbox HD does better than Dell's Zino. That's likely due to the Ion's dedicated memory versus the shared memory used by the Zino's 780G chipset. In raw computing power, however, the Zbox HD does worse than the Zino. Not terrible, but still slower. In general use, the Zbox HD just feels less responsive. Some of that comes from the 2.5-inch drive the unit uses versus the 7,200rpm desktop drive in the Zino, and the rest is just general Atom suckitude.

Overall, the Zbox HD has some merit. We're not convinced it's the perfect solution, as we'd still like something with a bit more x86 heft, perhaps a low-power Sandy Bridge CPU? But the Zbox handles the key needs: Silverlight, Flash, and Blu-ray, with no issues, and that's more than most streaming boxes can claim. **—GORDON MAH UNG**

VERDICT 7

ZOTAC ZBOX HD

+ CORDITE	**− CORDUROY**
Stylish, small, and quiet.	Atom is still a poor excuse for a CPU; a bit clunky to initially set up.

$500, www.zotacusa.com

BENCHMARKS

	ZERO POINT	
Premiere Pro CS3 (sec)	449	480 (-6%)
MainConcept (min)	7,080	8,070 (-12%)
3DMark 2003	2,540	7,504 (+195%)
Quake III (fps)	192	145 (-24%)
Quake 4 (fps)	28.6	36.5

0 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point is a Dell Inspiron Zino HD equipped with a dual-core 1.5GHz Athlon X2 3250e, 2GB of DDR2/667, AMD 780G with integrated Radeon HD 3200, a 250GB 7,200rpm Western Digital hard drive, and 64-bit Windows 7 Home Premium.

Speaker Sparring

Headphones are for wimps

We dig the stands that angle the satellites up toward our ears, but we could do without the honeycomb grilles and the garish flared rings in Antec's Rockus 3D Speaker System.

OK, we'll admit that headphones—and headsets—have their place, especially when it comes to gaming. But when you're ready to rock the casbah, you need a set of speakers driven by a no-holds-barred amp augmented by a beefy subwoofer.

The gaming-speaker market has been so quiet lately that we feared Logitech's budget boxes had driven everyone else away, so we're happy to see two brand-new players enter the ring. The Antec and Corsair names are familiar enough to enthusiasts who enjoy building their own rigs. Antec manufactures a number of very solid power supplies, a host of CPU and case coolers, and a raft of enclosures. Corsair does the same, along with memory, SSD and USB storage, and the kick-ass HS1 USB gaming headset we reviewed in December 2010.

Neither company has ever manufactured speakers, but they've both brought in development teams with plenty of experience. It's also worth noting that each company already has deep knowledge when it comes to building two of the key components in a powered speaker system: the enclosure and the power supply. Will that be enough for these rookies to score? We connected both systems to an Asus Xonar Essence ST soundcard to find out. –MICHAEL BROWN

ANTEC ROCKUS 3D SPEAKER SYSTEM

If you think like us, you dread seeing a 3D moniker emblazoned on any speaker system. If the material isn't recorded that way, don't monkey with it. Antec wisely gives you the choice of running the audio through its digital signal processor or just reproducing what the artist has wrought.

Given the number of aluminum cases Antec builds, it comes as no surprise that the company would choose the material for the cylindrical satellites in this 2.1-channel speaker system. Aluminum is an uncommon material in this price range, but it's a good choice. Aluminum doesn't flex, like MDF or even ABS plastic, so you hear more of the speaker and less of the enclosure. But it matters a great deal what type of drivers go into those enclosures, and Antec tries to get away with one-way, 2.5-inch paper-cone drivers (more on that when we discuss the system's performance). The satellites don't use hardwired cables, but you'll need either RCA couplers or RCA plugs you can solder onto longer cables if the ones provided aren't long enough (the other ends of the cable are tinned wire that connect to spring clips on the subwoofer).

The subwoofer consists of a 6.5-inch active driver aided by a 9-inch passive radiator housed in the more typical MDF cabinet. The active driver is mounted in the rear of the cabinet and the passive radiator is in front, so the unit performs best with its back 10 or 12 inches away from a wall. The sub houses the amp and power supply and has one set of stereo RCA inputs, a 1/8-inch aux input, and a TOSlink digital input. A hardwired puck controls the volume, switches between analog and digital inputs, and toggles the DSP's 3D algorithm on and off. What it's sorely missing is a headphone jack and an aux input you could plug a digital media player into.

We thought the absence of dedicated tweeters would flatten the high end, but it didn't; the satellites sounded brittle and harsh, instead. When we pumped Van Halen's "Everybody Wants Some" through the system and cranked the amp way up, the satellites sounded as though they were tearing themselves apart. Could this be related to Antec's decision to use a Class C amp? Class C amps are extremely efficient, but they also produce a great deal of distortion and are more commonly found in megaphones and walkie-talkies, devices that aren't expected to produce high-fidelity sound. We're not saying the Rockus satellites sound like megaphones, but they are pretty darned harsh.

The subwoofer scored better. The computer-speaker market is filled with flabby subs, and Antec's delivers a relatively tight, well-defined low-end; but it's just not a good match for the satellites. We like bass we can feel in our gut, and this one can't emerge from the shadow of those banshee satellites.

VERDICT	6
ANTEC ROCKUS 3D SPEAKER SYSTEM $250, www.antec.com	

The plain-Jane looks of Corsair's SP2500 masks a monster sound system.

CORSAIR SP2500 GAMING AUDIO SPEAKERS

There is absolutely nothing subtle about Corsair's SP2500 Gaming Audio Speakers: This monstrous 2.1-channel system could start a riot. After just a few minutes listening to Les Claypool shred his stand-up acoustic bass on the Primus classic "Mr. Krinkle," with the amp cranked way beyond sensible, we felt an overwhelming urge to start breaking furniture. So we turned the volume down and started hacking zombies in Left4Dead 2, instead.

The SP2500 is an interesting mélange of strength and refinement. The subwoofer and speaker cabinets are brutishly powerful and unapologetically plain to behold, but the system delivers more features than we could ask for, it sounds amazing, and it's very reasonably priced. The satellite cabinets are fabricated from ABS plastic, for example, but the drivers inside are bi-amplified by four discrete Class D amplifiers inside the subwoofer cabinet.

The 1-inch silk dome, ferrofluid-cooled tweeters each receive 16 watts, while the 3-inch treated-paper midranges get 40 watts each. The hulking subwoofer consists of an 8-inch long-throw paper driver housed in an MDF cabinet. The sub's large size is dictated by Corsair's decision to build a fourth-order band-pass design: The bass driver, which is powered by two bridged 60-watt Class D amps, is enclosed in a sealed chamber and fires into a separate chamber containing a fluted port. This subwoofer produced deliciously tight, well-defined bass whether we were rocking out with Van Halen or firing rockets in Call of Duty. Yowza! The sub's relatively thin walls, however, make us wonder how long the fun will last.

Corsair unconventionally uses four-pin ATX power-supply plugs to connect the satellites to the speakers, so it should be easy enough to make your own cables if these aren't long enough. Corsair also provides a set of stands that angle the satellites up toward your ears when they're placed on your desk, or you can put them in the back of the cabinets to angle the speakers down if they're sitting on a bookshelf above you. Source inputs are in the form of stereo RCA plugs on the sub. There's also a 1/8-inch aux input on the sub and a second 1/8-inch aux input on the tethered remote control (which also has a 1/8-inch headphone output and a USB port, just in case Corsair ever decides to release new firmware for the system's integrated DSP).

The S2500's remote is so cool you won't mind that it's hardwired to the sub. It boasts a 1.8-inch color LCD, independent volume control for the satellites and the subwoofer, and easy-to-navigate menus. Corsair provides a range of EQ profiles and DSP programs (Club, Stadium, Concert Hall, etc.) that you'll probably never use, but the Late Night program highlights another of the SP2500's cool features: active digital crossovers. Engage the Late Night DSP program, and the amplifier will shunt bass frequencies away from the sub and into the satellite's midranges so you don't bug your significant other—or your neighbors.

We still prefer B&W's MM-1 or the combination of Audioengine's N22 amp and P4 speakers for critical listening, but each of those systems cost twice as much as the P2500, and neither will fill as large a room.

SPECS

	Antec Rockus 3D	Corsair SP2500
Satellite Speakers	2.5-inch full-range paper cone	1-inch silk dome tweeter; 3-inch midrange paper cone
Satellite Enclosures	Aluminum	ABS plastic
Subwoofer	6.5-inch active driver; 9-inch passive radiator	8-inch long-throw driver, fourth-order bypass design
Subwoofer Enclosure	16mm MDF	12mm MDF
Amplifier Class	Class C	Class D
Stated Power Rating	25 watts to each satellite; 100 watts to the subwoofer	16 watts to each tweeter; 40 watts to each midrange; 120 watts to the subwoofer
Inputs	1/8-inch and RCA for analog stereo; TOSlink (digital)	Two 1/8-inch and RCA for analog stereo
Outputs	Binding clips for speakers	ATX PSU sockets for speakers; 1/8-inch on remote for headphones

VERDICT **9**

CORSAIR SP2500 GAMING SPEAKERS
$230, www.corsair.com

Fractal Design Define R3

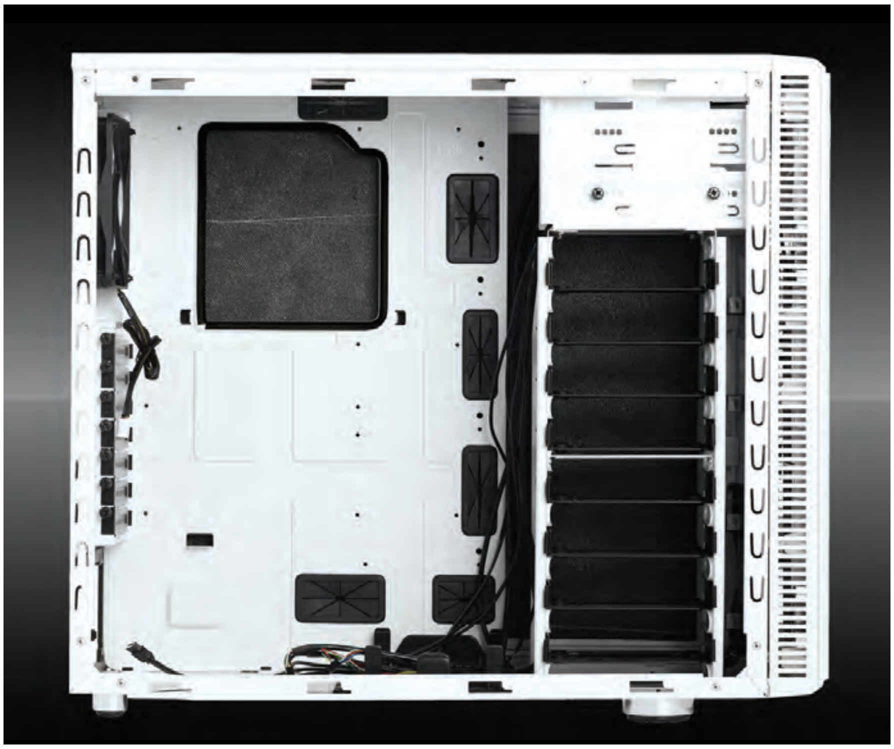
Scandinavian design that doesn't ship flat-packed

Fractal Design's Define R3—the first Fractal case that will be widely available in the States—marries cool Scandinavian design with a hefty dose of acoustic foam and lots of nice touches.

The Define R3 is available in four colors: black, grey, silver, and white. We chose the white one because, damn, something about an all-white case with a great paint job just gives us the warm-and-fuzzies. And it really is a great paint job—it's all smooth and glossy on the outside and matte on the inside, like the gods intended. The case's frame and panels are all steel, and the side panels are quite heavy—due in part to the dense sound-absorbing foam panels they include. The case includes a nicely weighted front-panel door (with the hinges on the left), with acoustic foam on the inside and side vents so the front fans can continue to pull air into the chassis.

The Define R3 ships with just two 12cm fans (front and rear), but it has room for five more. Behind the front door are two easy-open filtered fan bays—the top one is unoccupied, but easy to clip a second fan into. The top panel has room for two 12cm or 14cm fans, but by default those openings are covered with black plastic-and-foam acoustic damping panels; there's another of these setups on the left side-panel. The panels can be loosened to allow some airflow, or removed entirely, so you can either mount fans in the spaces or leave them empty for increased airflow (and noise). Up to three fans are controllable by a variable-speed fan controller that mounts in one of the case's seven PCI-E expansion slots.

The motherboard tray includes a cutout for CPU coolers and several grommeted cable-routing holes. Unfortunately, the routing cutouts are rounded rectangles, and the grommets are very easy to knock out and hard to put back in. They're also awkwardly placed. One, which is in a perfect position to route the 8- and 24-pin ATX power cables behind the motherboard tray, can only be used for standard-size PSUs. Longer PSUs are still supported (if you remove the fan mount at the bottom of the case). There are several cable tie-downs on the back of the mobo tray, but due to the acoustic padding there's not much room between the side panel and the mobo tray.



The eight hard-drive trays are nice (and can hold SSDs, too), but we'd trade a few of them for enough room to run a Radeon 5970. With some chassis, the top bays are removable to accommodate longer cards; we wish that were the case here.

With the stock fans and ModuVent panels in place, the case is very quiet, even with our CPU cooler running full blast. GPU temperatures were quite high, which is to be expected from a case without a side air intake (though that can be added easily), while CPU temperatures were on par with the NZXT Phantom (reviewed in the January issue). CPU temperatures dropped further when we removed the ModuVent panels—adding more fans would help, too.

Despite a few quirks, overall build quality is great, and with the Define R3, Fractal has done a great job of reducing case noise while still allowing for easy insertion of more fans. At $120 for the white version and $110 for the others, the Define R3 is priced to move. If the understated and classy design of the Define R3 speaks to you, it's nice to know you don't have to choose between acoustic performance and the potential to add more fans. **–NATHAN EDWARDS**

BENCHMARKS

	Fractal Define R3	NZXT Phantom	BitFenix Survivor
CPU Temp @ 100% burn (C)	49.75	**49**	52.5
CPU Temp @ idle (C)	35	**31.75**	35.25
GPU Temp (C)	65	**54**	59
System Temp (C)	34	**33**	36

Best scores are bolded. For our case testing, we use an EVGA 680SLI motherboard, stock-clocked Q6700 with a Thermaltake Contac29 cooler, an Nvidia 8800 GTX (with a Radeon 5970 for size testing), and a Corsair AX850 power supply. We use the case's stock complement of fans on their highest settings.

VERDICT 8

FRACTAL DESIGN DEFINE R3 ARCTIC WHITE

+ FRACTAL	– JACKAL
Attractive, elegant design; quiet; well-built; room for plenty of fans.	Only two fans, two optical drives, and two USB ports; heavy side panels; a side fan would be nice.

$120, www.fractal-design.com

Sennheiser Communications PC 333D G4ME

This gaming headset offers gorgeous sound, but at what price?

Sennheiser isn't a name you usually associate with gaming headsets—the company hasn't, after all, traditionally been a player in that market, and its entry into it hasn't come with much fanfare. All the same, we were pretty psyched when our review unit of the company's new G4ME 333D headset came in.

Gaming headset pedigree or no, Sennheiser is known for making some of the best headphones around. In one respect, we weren't disappointed. The PC 333D is, hands down, the best-sounding gaming headset we've ever tested. For gaming, the sound quality and 3D positioning are fantastic. Even for music, the PC 333D is fantastic, with a phenomenal dynamic range, crystal-clear highs and lows that are powerful without being muddy. It is, in short, the best sound quality you're going to find in a gaming headset.

Construction is decent overall, if a bit plasticky, and features a "dj hinge," which lets you swivel the right can forward or backward about 45 degrees so you can keep one ear free to hear your environment. Another cool feature of the 333D is the microphone boom, which automatically mutes your mic when it's swiveled to the upright position. The set can be used with analogue jacks, or as a USB device with the included external USB soundcard—a feature we always appreciate.

Unfortunately, there's one big drawback to the PC 333D: It's too tight. The foam around the ear cup is not the softest, and the set clamps down very hard on your head, leading to sore ears at best and a sinus pressure–like headache at worst. We passed the 333D around at the office, and the folks with larger heads reported that the snugness was enough to make using the headphones extremely unpleasant. Those with smaller heads weren't bothered much. Thus, we're giving the 333D headset high marks for amazing sound and good features, but with a warning: Don't buy this product if you've got a big noggin, and if you do buy it, get it from someplace with a good return policy. –ALEX CASTLE

The PC 333D G4ME offers great sound for little heads.

VERDICT 8

SENNHEISER COMMUNICATIONS PC 333D G4ME

+ CALCULON	– CLAMPS
Unrivaled sound quality; includes external USB audio dongle; convenient auto-mute boom.	Set is too tight to be comfortable on medium to large heads; plasticky construction.

$240, www.sennheiserusa.com

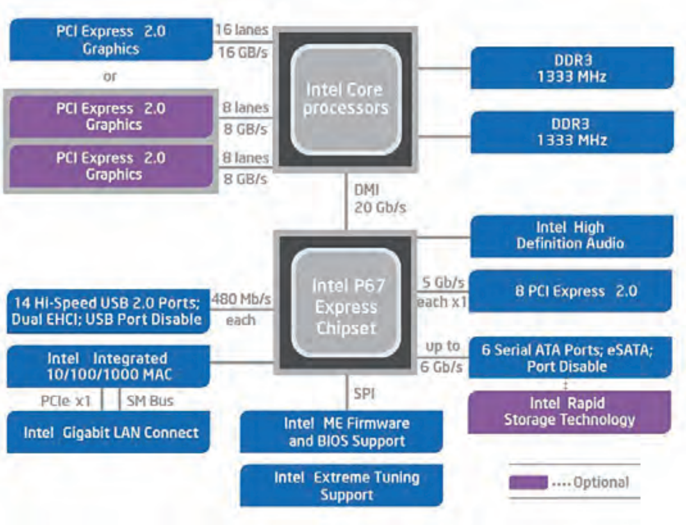
LAB NOTES

Is Intel Slowly Strangling PCI-E?

Without X58, support for the interface becomes more limited

GORDON MAH UNG
SENIOR EDITOR

Right or wrong, the Federal Trade Commission's settlement with Intel effectively forced the company to support PCI-E for six years because it feared Intel would hobble the interface in order to hurt GPU-based computing. For 98 percent of people, it's not an issue. But with Intel mulling a replacement for X58 later this year, people will once again worry about the fate of PCI-E. The problem is with the fairly limited PCI-E support in Sandy Bridge chips. The chip offers but a single x16 PCI-E 2.0 connection that can be split into two x8 connections for SLI or CrossFireX support. But what about three-way graphics? That can't be done without additional bridge chips, à la Nvidia's nForce 200, which adds cost and complexity to a board. So, should you worry? Probably not—there's still enough bandwidth to go around. However, I'd rather see Intel continue to support an enthusiast platform such as X58, because I know enthusiasts always want more, and P67 doesn't really give you more when it comes to PCI-E.



Intel P67 Express Chipset Platform Block Diagram

KATHERINE STEVENSON
DEPUTY EDITOR

Over the last month, I've been getting familiar with my first smartphone—a Samsung Focus running Windows Phone 7. Surfing the web on a tiny screen wasn't much of a draw for me—although it has come in handy a few times. Mostly, I like having a detailed calendar, access to email, and a decent camera with me at all times.

ALEX CASTLE
ONLINE MANAGING EDITOR

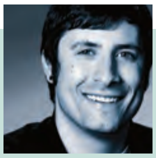
WoW Cataclysm just came out, and (despite my better instincts) I decided to see how it is. I haven't played WoW in years, and I'm surprised that the game has managed to get even more polished than before. All the same, I'm going to try to quit playing before I risk getting hooked.

ALAN FACKLER
ASSOCIATE EDITOR

I just spent my weekend playing with new Android tablets from ViewSonic and Samsung, and I'm finally starting to see potential in such devices. The Android-based Dell Streak and Cherry Pad left a really rotten taste in my mouth, but these two, particularly the Samsung Galaxy, were snappy and intuitive. The tech is there, now let's up the screen size, dammit!

AMBER BOUMAN
ONLINE FEATURES EDITOR

Amid testing large 3D displays, I've become interested in Internet-enabled TV. Between the Logitech Revue and the Boxee, and all the software solutions available, it's definitely way past time to upgrade my television-watching experience. I'm interested to see what happens in the next year or so, but in the meantime, I'll be busy trying out all the currently available options.



NATHAN EDWARDS
SENIOR ASSOCIATE EDITOR

My birthday's in February. My requests are reasonable: I want somebody to release a decent game for Android. I'd also like Silverlight support in Chrome OS, and a working Xbox 360. I would wish for a minion, but since Alan is officially the Associate Editor now, and I'm the Senior Associate Editor, I think that wish already came true.

We tackle tough reader questions on...

▸WHS Backup

▸Case Reviews

▸CPU Battles

Does Size Matter?

I have two computers that I want to pit in a proc fight. The first is a 3.06GHz Pentium 4 from 2003. The second was just given to me in a Mac mini. It's a 1.83GHz Core 2 Duo. Which one will get clock-blocked and which one will win?

—JumbleeNT

Senior Editor Gordon Mah Responds: This one is just too easy. A 1.8GHz Core 2 Duo will eat a Pentium 4's lunch all day long. Even though that 3.06GHz P4 has Hyper-Threading, it's still going against a dual-core that has a more efficient architecture, runs cooler, and uses less energy. A P4 can barely clock block an Atom dual-core. By the way, the Mac mini's specs are actually fairly decent for an HTPC application. Most HTPC mini PCs are Atom- or low-clocked Athlon 64–based. If you want something that will wail on your Mac mini, check out ASRock's Vision 3D 137B. It's pricey ($850) but comes with a 2.4GHz Core i3-370M and a GeForce GT 425M PC. We'll be reviewing one in a future issue.

New Case Rules

About every other year, a friend who builds computers and I comb through Maximum PC's Best of the Best section to build our own dream machine. I have seldom been led astray by the magazine's recommendations—except in the matter of cases. On more than one occasion, I've had the feeling that case evaluations are made from the perspective of computer builders rather than us poor wretches who use the machines and will eventually want access to fans, power supplies, videocards, and other components.

If I had one message for the folks on your team who evaluate cases it would be this: Any case without easy access to the card slots can receive no verdict higher than a 4. Better yet, adopt a policy of refusing to review cases that do not provide easy access to the cards. Disqualify a few cases on that basis, publicize the fact for readers and manufacturers, and I'd wager that case designers might become a little more attentive to the needs of users.

—Harry Frank

Senior Associate Case Wizard Nathan Edwards Responds: As a matter of fact, my review policy for cases does take into account ease of building and rebuilding. I do penalize cases for making certain parts difficult to reach or replace, and I reward cases for their attentiveness to the needs of upgraders—that's why I lauded the advent of motherboard tray cutouts, so CPU coolers can be replaced without removing the entire motherboard from the case.

It's not in our policy, however, to arbitrarily assign scores based on the ability or inability of a product to meet one specific criterion—unless the criterion is: Does it work?

Back up Your Backup?

I have a question regarding Windows Home Server, particularly in light of your revelation regarding Vail's ability to perform offsite

CUTCOPYPASTE

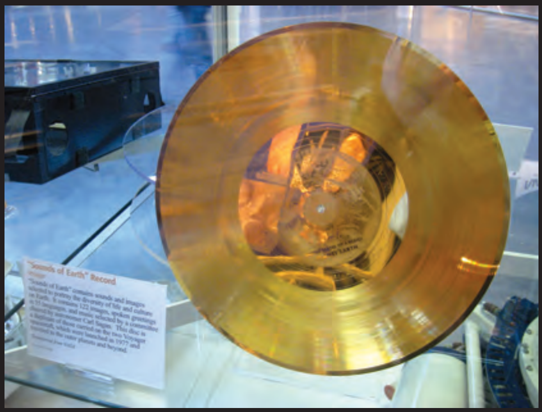
▶ In the Holiday issue, we juxtaposed the names of the two entrants in our NAS vs. Windows Home Server Deathmatch.

▶ Also in the Holiday issue, we printed the wrong benchmark numbers for the Radeon HD 6850 reference board. The correct numbers can be found at http://bit.ly/ecvM4G.

NOW ONLINE

Build a Digital Time Capsule

If you've ever built a time capsule before, it's probably been of the baseball-cards-and-cassette-tapes variety, and not a space-age digital archive ready to store your data and personal electronic artifacts for future generations. This month on MaximumPC.com, we show you the techniques you'll need to know to create the ultimate technological time capsule. Interested? Check it out at http://bit.ly/i04Aok.



backup ("The Future of Windows," December 2010). While I would admit I have a better offsite backup strategy than most, even the most vigilant plan will have time delays before a copy of the latest data can be transported offsite. Yes, you could use a cloud service as an offsite repository, but besides potential privacy issues, backing up even 1TB would be cost-prohibitive.

It would be awesome if I could set up a second WHS at, say, my sister's place in Florida, and somehow have my server automatically back itself up offsite at designated intervals. Is this possible?

—Edward Lopategui

Reviews Editor Michael Brown Responds: There is a free program called CrashPlan, from Code 42 Software, that allows you to back up a PC to a friend's or family's PC over the Internet. I have not tried this program myself, and Code 42 Software does not officially support Windows Home Server, but it *does* describe how to install their program on a WHS machine. You can read about it at http://bit.ly/gq8uC7.

A quick aside about Vail: I don't think I'll be making the upgrade myself unless Microsoft reconsiders its decision to pull its Drive Extender technology out of the product. Drive Extender's ability to build an array using any mixed collection of hard drives is one of the primary reasons I adopted the OS.

The Good Old Days, Sigh

In your Doctor's response to Cosmin Adam's questions about transplanting hard drive platters (January 2011), you state, "We don't know of any nonprofessional who's ever opened up a hard drive and got it working again." As it turns out, I do know of a nonprofessional who successfully opened a drive.

Back in the days of 286 clones, when drives were still full-height, my father had a hard drive from work fail. Since it was a dead drive, he figured he had nothing to lose by taking it apart and looking at what was inside. Working in our mildew-filled basement less than 20 feet from a smoky, ash-filled wood stove, he opened up the drive, messed around inside for a bit, and closed it back up again, *while smoking a cigarette*.

After that, the drive worked for a year or two before being replaced by a higher-capacity volume. Not that his "field-expedient repair" was perfect. The drive was very loud and sometimes it would not spin up without being lifted a few inches and dropped onto our desk. But it did work. I'm not saying I would recommend opening a drive to tinker with the insides. I seriously doubt it would work in today's drives considering their smaller size and tighter packing of bits on the platters. But it can, sometimes, be done. (And if it fails, at least you get access to some good rare-earth magnets!)

—Charles Moore

ShellExView It

In the June issue, Alex Castle complained about Microsoft not providing an easy way to control the contents of the Windows context menu. I use a free utility written by Nir Sofer called ShellExView. The ShellExView utility displays the details of shell extensions installed on your computer, and allows you to easily disable and enable each one. This and many other useful utilities are available on Mr. Sofer's website (www.nirsoft.net). I also use his ShellMenuNew utility. It displays the list of all menu items in the New submenu of Windows Explorer and allows you to easily disable unwanted menu items. These utilities provide a safe and easy way to turn stuff off or on as you see fit.

—David J. Ellis

Online Managing Editor Alex Castle Responds: Thanks for the tip, David. I tried out ShellExView and liked it so much that I'm using it in this month's How To on page 60.

LETTERS POLICY Please send your questions and comments to comments@maximumpc.com. Include your full name, city of residence, and phone number with your correspondence. Letters may be edited for space and clarity. Due to the amount of mail we receive, we are unable to respond personally to all queries.

NEXT MONTH

COMING IN MAXIMUM PC's CPUs AND MOTHERBOARDS REPORT

MAR ISSUE

The Ultimate Videocard Roundup!

We just dumped a whole mess of videocards onto Contributing Editor Loyd Case, who is authoring a comprehensive comparative review across all major price ranges.

The Ultimate Power Users' Tips & Tricks Guide!!

We're compiling a massive list of tips, tricks, and shortcuts for the 15-plus most-popular Windows applications.

The Ultimate Budget Sandy Bridge Build!!!

Senior Associate Editor Nathan Edwards is picking his parts with the end goal of building a $900 next-gen rig. Can it be done? Find out next month.

HIGH-END GPU

EVGA GeForce GTX 580 SC

Nvidia's secrecy over the GeForce GTX 580 was meant to surprise AMD. And it did. Nvidia has returned to the top with a GPU that's finally faster than AMD's Radeon HD 5970 and, frankly, is everything the original GeForce GTX 480 was meant to be. The GeForce GTX 580 is no hybrid power-sipper, though. It's the equivalent of a big-block motor on a solid rear-axle muscle car. But sometimes, it's fun to lay scratch down the street with impunity, and the GTX 580 can do it.
www.evga.com

THE REST OF THE BEST

High-End Processor
Intel 3.33GHz Core i7-980X
www.intel.com

Midrange Processor
Intel 3.4GHz Core i7-2600K
Core i7-870
www.intel.com

Budget Processor
Intel 2.8GHz Core i5-760
www.intel.com

LGA1366 Motherboard
Asus Rampage III Extreme
www.asus.com

AM3 Motherboard
MSI 890FXA-GD70
www.msi.com

Midrange Videocard
Gigabyte GeForce GTX 470
GV-N470D5-131-B
www.gigabyte.com

Budget Videocard
Asus 460 ENGTX TOP
768MB
www.asus.com

Capacity Hard Drive
Western Digital Caviar
Black 2TB
www.wdc.com

Performance Storage
OCZ Vertex 2 100GB SSD
www.ocz.com

Air-Cooling
Cooler Master Hyper 212+
www.coolermaster.com

High-End Cooler
Prolimatech Armageddon
www.prolimatech.com

DVD Burner
Samsung SH-S223
www.samsung.com

Blu-ray Drive
Plextor B940SA
www.plextor.com

Full-Tower Case
Corsair 800D
www.corsair.com

30-Inch Display
HP ZR30w
www.hp.com

Wi-Fi Router
Netgear WNDR3700 V1
www.netgear.com

Speakers
Bowers & Wilkins MM-1
www.bowers-wilkins.com

Gaming Mouse
Madcatz Cyborg R.A.T.7
www.cyborggaming.com

Gaming Keyboard
Razer BlackWidow Ultimate
www.razerzone.com

Games we are playing

Fallout: New Vegas
www.fallout.bethsoft.com

Civilization V
www.civilization5.com

World of Warcraft: Cataclysm
www.worldofwarcraft.com

Minecraft
www.minecraft.net

For even more Best of the Best entries, such as home servers and budget components, go to www.maximumpc.com/best-of-the-best.

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